SAFEDRONEWARE

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'REPORT WITH INVENTORY OF RELEVANT NATIONAL AND EUROPEAN LEGISLATION, AND GUIDELINES FOR DEVELOPERS ON THE BASIS OF RELEVANT LAW'

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Author(s):	***Ivo Emanuilov***

[1] Centre for IT and IP Law.

ABSTRACT

This deliverable provides a general discussion of the international and Belgian legal framework applicable to operations of remotely piloted aircraft. Due to diverging use of many terms with different meaning in the field of unmanned aviation, the first part of the deliverable explains the different notions used and their meaning, establishing the use of common terminology in line with the international legal framework and the applicable Belgian legislation. It further discusses the applicable international legal framework and its impact on national and EU-level lawmaking in the field of unmanned aviation.

The report considers the recent developments at EU level in the field of unmanned aviation. While it is mainly focused on the rules of the existing legal framework, it also touches upon some recent initiatives of EASA and the European Commission. It discusses the importance of common legal rules at EU level for the successful 'take-off' of unmanned aviation and how the existing barriers might impair the commercial success of these technologies.

Following the analysis of the international safety legal framework, the report focuses on the specifics of the national legislation in Belgium. It situates the recently adopted Royal decree on the use of remotely piloted aircraft in Belgian airspace in the general aviation legal framework. It discusses the structure of the decree, focusing on the sections of importance to ensuring the safe operation of an unmanned aircraft. Finally, it will critically analyse the requirements of the royal decree in light of the recent policy and legislative initiatives at EU level. The report will particular focus on the level of autonomy allowed by the royal decree and will argue that a reasonable balance between safety and autonomy is critical to the success of commercial unmanned aviation.

The final part of the report focuses on the elicitation and implementation of the non-functional legal requirements in the context of SafeDroneWare. It briefly discusses the strategies for extraction and quantification of legal requirements, the difficulties encountered in the context of SafeDroneWare and possible strategies for mitigating the lack of sufficient clarity in the legal provisions. The report provides a simple set of points that that could facilitate the elicitation of non-functional legal requirements in the development of software for remotely piloted aircraft in Belgium.

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LIST OF ABBREVIATIONS

AGL	Above Ground Level
ATM	Air Traffic Management
ATS	Air Traffic Service
C2	Command and control
CC44	Chicago Convention on International Civil Aviation of 1944
DGTA	Federal Public Mobility and Transport Service Directorate General for Air Transport
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
GDPR	General Data Protection Regulation
HTA	Helicopter training areas
ICAO	International Civil Aviation Organisation
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
LFA	Low flying areas
PANS	Procedures from Air Navigation Services
QE	Qualified Entity
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
SARPs	Standards and Recommended Practices
TRA	Temporarily reserved airspace
TSA	Temporarily segregated airspace
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
VLOS	Visual Line of Sight

INTRODUCTION

SafeDroneWare is a project that aims to develop an architecture and a reusable, integrated framework for an unmanned aerial vehicle (UAV) platform. The project takes an integrated approach to developing low-level and application-level software, reliable communication, drone sensors and hardware to ensure maximum safety and to support autonomous UAV behaviour. This will help businesses maximize cost-effectiveness while using UAVs in compliant and safe ways, helping European industries flourish.

The present report corresponds to Task 6.1 'Inventory of relevant national and European law, and guidelines for developers on the basis of this inventory'. The research in this task sets out to identify the relevant national and European legal framework with a focus on certification, liability and the division of responsibilities. Recent developments in the field of unmanned aviation at EU level and in Belgium, in particular, will be studied in order to understand their implications in terms of safety of drone operations and autonomous flights. The report will summarise the applicable legal rules that have been used to elicit the non-functional legal requirements in Work Package 1 'Requirements Elicitation'. These rules will be critically discussed and the difficulties encountered will be explained along with possible strategies for developers to overcome them. Finally, a set of guidelines for developers engaged in the development of software frameworks for safe operations of remotely piloted aircraft will be drafted.

The report is structured in the following way.

Chapter I provides a general discussion of the international legal framework applicable to drone operations. Due to diverging use of many terms with different meaning in the field of unmanned aviation, the first part of this chapter will explain the different notions used and their meaning. It will suggest the use of common terminology in line with the international legal framework and the applicable Belgian legislation. The second part of the chapter will discuss the applicable international legal framework and its impact on national and EU-level lawmaking in the field of unmanned aviation.

Chapter II discusses the recent developments at EU level in the field of unmanned aviation. While it is mainly focused on the rules of the existing legal framework, this chapter also touches upon some recent initiatives of EASA and the European Commission. It discusses the importance of common legal rules at EU level for the successful 'take-off' of unmanned aviation and how the existing barriers might impair the commercial success of these technologies.

Chapter III focuses on the specifics of the national legislation in Belgium. This chapter will situate the recently adopted Royal decree on the use of remotely piloted aircraft in Belgian airspace in the general aviation legal framework. It will then discuss the structure of the decree, focusing on the sections of importance to ensuring the safe operation of an unmanned aircraft. The chapter will critically analyse the requirements of the royal decree in light of the recent policy and legislative initiatives at EU level. The chapter will particular focus on the level of

autonomy allowed by the royal decree and will argue that the balance between safety and autonomy is critical to the success of commercial unmanned aviation.

Chapter IV focuses on the elicitation and implementation of the non-functional legal requirements in the context of SafeDroneWare. It will briefly discuss the strategies for extraction and quantification of legal requirements, the difficulties encountered in the context of SafeDroneWare and possible strategies for mitigating the lack of sufficient clarity in the legal provisions. This analysis will result in the development of a simple set of points that that could facilitate the elicitation of non-functional legal requirements in the development of software for remotely piloted aircraft in Belgium.

CHAPTER I

INTERNATIONAL SAFETY LEGAL FRAMEWORK OF UNMANNED AVIATION

This chapter provides an overview of the applicable international safety legal framework of unmanned aviation. It discusses the applicability of major international treaties that concern civil aviation matters of interest to both public and private international law. The purpose of this study is to define the broad framework within which unmanned aviation could be regulated. For the sake of clarity, this study will not go into detailed discussions about the private international law aspects of liability and insurance since the application of these rules depend on the specific context and very often, on national rules.

Before discussing the international legal framework, it is important to find common ground for establishing a coherent taxonomy of the various notions and their meaning as used in the context of SafeDroneWare. There are multiple sources of concepts and notions, some of them overlapping, some of them contradicting with each other.[2] As a preliminary first step, it is thus necessary to briefly examine the existing definitions, classify them and select a set of concepts that will be used throughout the report. Distinguishing between the terms has practical relevance since often different terms may lead to different qualifications and different legal consequences.[3]

1. TERMINOLOGY

Many terms are currently in use when it comes to drones. The word 'drone' itself is widely used by the media and the general public but it is rarely seen, if at all, in the vocabulary of any of the aviation authorities.[4] Very often terms such as 'unmanned aircraft', 'unmanned aerial vehicle' (UAV), 'unmanned aircraft system' (UAS), 'pilotless aircraft', 'pilotless aerial vehicle', 'remotely operated aircraft', 'remotely piloted aircraft' (RPA) and 'remotely piloted aircraft systems' (RPAS) are used interchangeably. However, as will be shown later on, some of these terms have different meaning and should be clearly distinguished. There are various criteria for distinguishing between the different categories of unmanned means of transportation, but the ones that have practical relevance are two.

The first criteria distinguishes between unmanned vehicles based on the level of autonomy of the vehicle or, alternatively, on the level of involvement of the pilot. Thus, there are remotely operated vehicles and autonomous vehicles. Remotely operated vehicles are operated by natural persons from a distance and that implies that a human is consistently present, although remotely, during the operation of the vehicle. In contrast, autonomous vehicles are often regarded as

[2] For a good overview of the different terms and acronyms used, see Kristian Bernauw, "Drones: The Emerging Era of Unmanned Civil Aviation," *Zbornik PFZ* 66 (2016): 226.
[3] Benjamyn Scott, "Key Provisions in Current Aviation Law," in *The Future of Drone Use: Opportunities and Threats from Ethical and Legal Perspectives*, ed. Bart Custers (The Hague: T.M.C. Asser Press, 2016), 242.
[4] Ibid., 243.

'robots' which are self-governing, self-navigating and self-operating based on the combined actions of hardware sensors and adaptive software which processes the data collected by these sensors and adapts its behaviour based on the continuous changes in the environment.[5] In fact, self-adaptability is the key difference between automatic and autonomous vehicles.[6] While automation is linked with the ability of the vehicle to execute a set of instructions, autonomy is related to its ability to change its behaviour, to deal with uncertainty during runtime, taking into account the changes occurring in the environment. In its communication 'A new era for aviation: Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner', the European Commission clarified that "RPAS form part of the wider category of Unmanned Aerial Systems (UAS), which also includes aircraft that can be programmed to fly autonomously without the involvement of a pilot."[7] Furthermore, to avoid any doubt, the Commission further said that RPAS "are controlled by a pilot from a distance". In the following chapters, it will be demonstrated that distinguishing between automatic and autonomous vehicles is particularly important in terms of allocation of liability.

The second criteria distinguishes between an aircraft and an aircraft system. This distinction is practically important since it may have significant consequences, for example, when determining the scope of an insurance policy.[8] Thus, it is not the same for an insurer whether the operator and/or the remote pilot is insured for risks related only to the operation of the aircraft or for the whole aircraft system. The aircraft system may include the equipment that is required for the operation of the aircraft, but it may equally include simply ancillary components, such as thermal or hyperspectral cameras, that are not essential to the operation of the drone.[9] When and whether such an additional component will be considered part of the aircraft system, an essential component for the operation of the aircraft or an ancillary payload could be extremely important for defining limitations of liability.[10]

These distinctions play a crucial role in defining the scope of regulatory intervention. Thus, for example, the Belgian Royal decree on the use of remotely piloted aircraft in Belgian airspace is applicable only to 'remotely piloted aircraft' which implies that autonomous unmanned aircraft are not subject to the rules of the decree. The legal framework on drones in Belgium

[5] See more on self-adaptive software in Naeem Esfahani and Sam Malek, "Uncertainty in Self-Adaptive Software Systems," in *Software Engineering for Self-Adaptive Systems Ii* (Springer, 2013), 214.

[6] Some authors, such as Scott, 244., seem to consider autonomy and automation as alternatives. However, such a position fails to account for the fact that a system can be automatic without being autonomous. See more in Bernauw, 227.

[7] European Commission, "Communication from the Commission to the European Parliament and the Council 'a New Era for Aviation: Opening the Aviation Market to the Civil Use of Remotely Piloted Aircraft Systems in a Safe and Sustainable Manner'," (2014).

[8] Scott, 243.

[9] Bernauw, 226. argues that the word 'system' refers indeed to ancillary remote equipment component which is, however, required to operate the vehicle as opposed to the aircraft component. However, it remains unclear whether, for example, a camera will always be considered a non-essential payload and not a remote equipment component required for the operation of the aircraft. These issues need to be considered well in advance in order to ensure that all risks have been taken into account.

[10] Some authors consider that RPAS is an "*overarching term for the entire system comprising an Unmanned Aerial Vehicle (UAV) which is applied to describe a self piloted or remotely piloted aircraft that can carry cameras, sensors, communications equipment or other payloads, as well those which support unmanned flights such as air traffic management and remote controllers of such aircraft*". See in this sense Ruwantissa Abeyratne, *Convention on International Civil Aviation : A Commentary* (New York: Springer, 2013), 121.

fits into the existing national and international framework of air law. It is thus necessary to construe the concepts employed by this framework in light of the international air law framework in order to understand the meaning of the concepts used by national legislations.

At the international level, Article 8 of the Chicago Convention on International Civil Aviation of 1944 (CC44) refers to 'pilotless aircraft'. The provision does not provide a straightforward definition of 'pilotless aircraft' but rather mandates that a special authorisation is required by the state whose territory is overflown by the aircraft flown without a pilot. This definition is somewhat clarified by a circular released by ICAO under the title 'Unmanned Aircraft Systems (RPAS)'.[11] The document provides a glossary but subject to a disclaimer that the terms contained in it "have no official status within ICAO" and are used only in the context of the circular. The circular defines terms such as 'autonomous aircraft'[12], 'autonomous operation'[13], 'pilot-in-command'[14], 'remote pilot'[15], 'remote pilot station'[16], 'remotely-piloted'[17], 'remotely-piloted aircraft'[18], 'unmanned aircraft'[19] and 'unmanned aircraft system'.[20] Furthermore, in 2012, ICAO amended Annexes 2 (Rules of the air), 7 (Nationality and registration marks) and 13 (Accident investigation) to the Chicago Convention in order to clear the path for RPAS intended to be used by international civil aviation. Furthermore, in 2015, ICAO released a Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019) which is set to provide guidance on RPAS matters in the legislative and regulatory processes.[21]

In the case of EU, the legislative and regulatory processes are further detailed at either national or Union level. The criteria for this division will be examined in the following chapters. In the absence of any binding legal instruments adopted at EU level, the terms used in the proposals that are currently on the agenda seem to follow the distinctions made by ICAO in recognising remotely piloted aircraft as a subset of unmanned aircraft. The Commission is clear in saying

[11] ICAO, "Unmanned Aircraft Systems (Rpas) Cir 328- an/190," ed. ICAO (2011).
[12] Defined as 'an unmanned aircraft that does not allow pilot intervention in the management of the flight', ibid. ix.
[13] Defined as 'an operation during which a remotely-piloted aircraft is operating without pilot intervention in the management of the flight', ibid.
[14] Defined as 'the pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight', ibid x.
[15] Defined as 'the person who manipulates the flight controls of a remotely-piloted aircraft during flight time', ibid.
[16] Defined as 'the station at which the remote pilot manages the flight of an unmanned aircraft', ibid.
[17] Defined as 'control of an aircraft from a pilot station which is not on board the aircraft', ibid.
[18] Defined as 'an aircraft where the flying pilot is not on board the aircraft', ibid. It is to note ICAO has explicitly clarified here that RPA is a subcategory of unmanned aircraft.
[19] Defined as 'an aircraft which is intended to operate with no pilot on board', ibid.
[20] Defined as 'an aircraft and its associated elements which are operated with no pilot on board', ibid.
[21] Bernauw, 236.

that "drones which are automatically programmed – without being piloted, even remotely"[22] are not yet authorised for use neither by ICAO, nor by EU rules.[23]

In an attempt to remedy the uncertainty brought by the existence of diverging regulations, EASA proposed a 'Prototype' Commission Regulation on Unmanned Aircraft Operations.[24] The proposal aims to fit into the new framework that is being discussed in the context of the reform of the existing Union provisions dealing with civil aviation safety as currently contained in Regulation (EC) No 216/2008.[25] The 'prototype' regulation provides, among others, for definitions of 'automatic flight'[26], 'remote pilot'[27], 'unmanned aircraft'[28], and 'unmanned aircraft system'.[29] Finally, the systemic interpretation of Article 45 and Annex IX of the Proposal for a Regulation of the European Parliament and of the Council on Common Rules in the Field of Civil Aviation and Establishing a European Union Aviation Safety Agency, and Repealing Regulation (Ec) No 216/2008 of the European Parliament and of the Council could be seen as an indication that the European rules will closely follow the definitions of ICAO. In fact, the adoption of this approach is already visible at national level.

In Belgium, the Royal Decree on the use of remotely piloted aircraft in Belgian airspace closely follows the definitions of ICAO. Thus, the decree defines terms such as 'model aircraft'[30], 'remotely piloted aircraft'[31], 'remotely piloted aircraft system'[32], 'remote pilot'[33], and 'manned aircraft'.[34] The approach of the Belgian legislator in defining 'remotely piloted aircraft' could

[22] The Commission could be criticised for its choice of words in this memo. As previously noted, the mere fact that a drone is 'automatically programmed' does not mean ipso facto that it does not require a pilot but rather that some of its functions may have been pre-programmed to follow a particular routine. The distinction between autonomous and automatic drones is crucial. For example, the Belgian Royal decree on the use of remotely piloted aircraft in Belgian airspace explicitly prohibits the autonomous operations of unmanned aircraft which do not allow for the intervention of a pilot. It is the possibility for pilot intervention that determines whether the flight is autonomous or not, ie whether the aircraft is capable of handling a complete flight from take-off to landing without a single manual instruction from the pilot. Unlike autonomy, automation is not *prima facie* prohibited. Thus, for example, the aircraft's software could provide for automatic obstacle avoidance or for automatic emergency landing. In any case, the possibility for a pilot intervention deprives the aircraft from its 'autonomy'.

[23] European Commission, "Memo Remotely Piloted Aviation Systems (Rpas) - Frequently Asked Questions," (2014).

[24] European Aviation Safety Agency, "'Prototype' Commission Regulation on Unmanned Aircraft Operations," ed. EASA (2016).

[25] European Commission, "Proposal for a Regulation of the European Parliament and of the Council on Common Rules in the Field of Civil Aviation and Establishing a European Union Aviation Safety Agency, and Repealing Regulation (Ec) No 216/2008 of the European Parliament and of the Council (Com/2015/0613 Final - 2015/0277 (Cod))," ed. European Commission (2015).

[26] Defined by Article 2(2)(c) as 'flight following preprogramed instructions, loaded in the unmanned aircraft (UA) flight control system, that the UA executes'.

[27] Defined by Article 2(2)(p) as 'natural person who manipulates the flight controls of a UA, as appropriate, during a flight and is responsible for safely conducting the flight'.

[28] Defined by Article 2(2)(t) as 'any aircraft operated or designed to be operated without a pilot on board'.

[29] Defined by Article 2(2)(v) as 'UA and any equipment, apparatus, appurtenance, software or accessory that is necessary for the safe operation of the UA'.

[30] Defined by Article 1(9) as 'remotely piloted aircraft used exclusively for sport and recreational purposes'.

[31] Defined by Article 1(4) as 'an unmanned aircraft with a maximum take-off mass not exceeding 150 kg, piloted from a remote pilot station'.

[32] Defined by Article 1(5) as 'remotely piloted aircraft, its associated remote piloting system(s), the necessary command and control connections and all other elements, as specified in the type design'.

[33] Defined by Article 1(7) as 'a person who performs the tasks essential to the operation of a remotely piloted aircraft and who, where applicable, operates the flight controls of a remotely piloted aircraft during its flight'.

[34] Defined by Article 1(11) as 'any aircraft designed to be operated with a pilot on board'.

be criticised for its imprecision. Thus, for example, the definition refers to 'unmanned aircraft' without defining explicitly what is covered by that term. It is reasonable to assume that *per argumentum a contrario* from the definition of 'manned aircraft' in Article 1(11), unmanned aircraft should be understood in the same sense as defined in ICAO's and EASA's documents, ie, as a an aircraft which is *designed* (emphasis added) to operate with no pilot on board.

This short overview of the existing terms demonstrates that the choice of words is not irrelevant when referring to drones, remotely piloted aircraft or unmanned aircraft. Different terms may lead to different interpretation and different legal consequences. It is therefore advisable that a common taxonomy of terms is established. Despite some critical remarks to the approach of the Belgian legislator, it is worth noting that the definitions of the royal decree fit into the framework delineated by the documents issued by ICAO and EASA so far. While these documents have no binding effect unless promulgated into legislation, in their role of 'soft law' sources, they may be used as guidance by the national legislators in adopting national rules.

Considering this analysis and in line with SafeDroneWare's national scope, the present report adopts the definitions used by the Belgian Royal decree on the use of remotely piloted aircraft in Belgian airspace complemented, where necessary and applicable, with inspiration from the documents and proposal issued by ICAO and EASA.

2. THE INTERNATIONAL LEGAL FRAMEWORK FOR SAFETY OF UNMANNED AVIATION

The reference to both 'international legal framework for safety' and 'unmanned aviation' in this report is somewhat arbitrary. As it stands, there is no *specific* international legal framework for safety of remotely piloted aircraft, nor is there an official use of the term 'unmanned aviation'. However, for the purpose of the present study, the terms will be used to refer to the possible set of international rules on safety that may be considered applicable in the context of remotely piloted aircraft. The purpose of this overview is to situate the Belgian national legislation into the broader legal framework and to identify sources which may be used for teleological interpretation of vague concepts used in national law.

Remotely piloted aircraft give rise to a number of concerns which manned aviation has dealt with for a long period of time, such as airworthiness regulations, and the integration into non-segregated airspace.[35] Safety concerns have long been recognised as the major obstacle before the 'mass use' and integration of remotely piloted aircraft into non-segregated airspace.[36] Thus, it is reasonable to ask: ***is it not possible to adapt the existing international rules for manned aviation to the operations of remotely piloted aircraft?***

The main legal instrument governing manned aviation at international level is CC44. In its Manual on Remotely Piloted Aircraft Systems (RPAS), ICAO highlighted its primary goal of providing international regulatory framework through Standards and Recommended Practices (SARPs) with supporting Procedures from Air Navigation Services (PANS) and guidance

[35] Abeyratne, 118.
[36] Bernauw, 228.

material, to support the routine operation of RPAS in a safe and harmonised manner comparable to that of manned aviation.[37,38]

CC44 lays specific emphasis on the provisions dealing with the safety of operations. The convention applies to aircraft, defined by Annex 2, 6 & 8 of CC44 as "*[a]ny machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface*". The systemic interpretation of Annex 7 *juncto* Annex 2 of CC44 leads to the conclusion that remotely piloted aircraft fall within the definition of 'power-driven aircraft' regardless of whether it concerns a fixed-wing aeroplane, lighter-than-air airship, or a rotary-wing helicopter. The fact that remotely piloted aircraft are covered by the definition untied ICAO's hands to exercise its regulatory competencies and introduce rules that also cover remotely piloted aircraft.[39]

Autonomy

There is an ongoing discussion in literature on the interpretation of Article 8 CC44 and its reference to 'pilotless' aircraft. The prevailing interpretation is that the provision of Article 8 refers to cases where the pilot is not physically located on board the aircraft. This interpretation, however, fails to account for the grammatical interpretation of the provision which implies that the aircraft operates without a pilot in all cases. Some authors have suggested that interpreting Article 8 in light of the general rule of interpretation of treaties enshrined in Article 31 of the Vienna Convention on the Law of Treaties will lead to the conclusion that only autonomous aircraft are included, ie aircraft that have no pilot at all.[40] The rule of Article 31 of the Vienna Convention states that the interpretation should be in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. Such interpretation, however, seems to leave out of CC44's scope remotely piloted aircraft and thus needs to be corrected by means of teleological interpretation which also considers the object and the purpose of the convention.

The following additional criticisms could be made on the interpretation of the provision. The provision's text reads that the aircraft is "capable of being flown", implying that someone else is still flying it, even though there is no pilot on board. If that was not the case, the drafters would have chosen the active verb 'fly' to describe that the aircraft is indeed autonomous. Some might argue the French text makes use of the present participle of the verb '*pouvoir*' (*pouvant*) to describe that an aircraft 'that may fly'. However, the Russian text refers to „*воздушное судно, способное совершать полеты без пилота*" which could mean that both the aircraft is capable of flying and that it capable of being flown. Furthermore, in the foreword to CC44, the convention's drafters have explicitly stated that the convention's language versions are equally authentic, which means that no precedence could be given to the English text over the French

[37] International Civil Aviation Organization, "Manual on Remotely Piloted Aircraft Systems (Doc 10019)," ed. International Civil Aviation Organization (2015), V.
[38] Ruwantissa Abeyratne, "Remotely Piloted Aircraft Systems: Some Unexplored Issues," *Air and Space Law* 41, no. 3 (2016): 291.
[39] Pablo Mendes de Leon and Benjamyn Ian Scott, "An Analysis of Unmanned Aircraft Systems under Air Law," in *Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance*, ed. Aleš Završnik (Cham: Springer International Publishing, 2016), 189.
[40] Ibid., 192.

or the Russian one. However, as Article 31 of the Vienna Convention prescribes, the interpretation should also take into account the object and the purpose of the treaty. Furthermore, the systemic interpretation of the first and the second sentence of the provision's text reveals that a degree of control is required and that the control exercised is not autonomous.[41] Thus, we disagree with the authors who argue that "[i]t is unclear from only the text of the Article which interpretation prevails".[42] The comparative grammatical, teleological and systemic interpretation of Article 8 all point towards aircraft that can fly only when being controlled from outside, ie Article 8 CC44 does not provide for autonomous flights.

Territorial scope

Article 8 of CC44 subjects the operation of these aircraft to national authorisation.[43] As CC44 regulates international aviation, domestic operations will not be covered by it unless they meet the international criterion.

While in the military context this criterion is easily met, this will not be the case very often for civil applications of remotely piloted aircraft. While the international element is often considered by national legislation, in many cases it is the national law that will determine the applicable rules in terms of both territorial scope and safety.

Safety

There are currently no international standards and recommended practices (SARPs) adopted at international level.[44]

Article 31 CC44 provides that every aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued or rendered valid by the state in which it is registered. In addition, Annex 8 CC44 (in its ninth edition) lays down the SARPs for the issuance of airworthiness certificates but they only concern aeroplanes over 5700 kg certified take-off mass and helicopters "without a limitation on the mass of an aircraft which is intended for the carriage of passengers or cargo or mail in international air navigation".[45] It follows that the SARPs established with Annex 8 CC44 will not be applicable to remotely piloted aircraft. The tenth edition of the amended the requirements to also cover helicopters with certified take-off mass over 750 kg.

[41] In the English, French and Russian language versions, as follows: "the flight of such aircraft without a pilot in regions open to civil aircraft shall be so ***controlled***", "le vol d'un tel aéronef sans pilote dans des régions ouvertes aux aéronefs civils soit soumis à un ***contrôle***" and "полете такого воздушного судна без пилота в районах, открытых для гражданских воздушных судов, обеспечить такой ***контроль***" (emphasis added).
[42] Mendes de Leon and Scott, 193.
[43] Bernauw, 229.
[44] Abeyratne, *Convention on International Civil Aviation : A Commentary*, 118.
[45] Ibid., 124.

Article 29 CC4 stipulates that every aircraft of a contracting state, engaged in international navigation, shall carry the following documents in conformity with the conditions prescribed in the convention:

- Certificate of registration;
- Certificate of airworthiness;
- Appropriate licences for each member of the crew;
- Journey log book;
- Aircraft radio station licence, if equipped with radio apparatus;
- List of names of passengers and places of embarkation and destination, if the aircraft carries passengers;
- Manifest and detailed declarations of the cargo, if the aircraft carries cargo.

These requirements are applicable to remotely piloted aircraft. Some authors have recognised, however, the difficulty in meeting some of the requirements, eg, the carriage of documents in the aircraft itself. Thus, these authors suggest that a possible solution might be to store the data and licences electronically on the board the vehicle. This poses questions of the legal validity of such form in the absence of explicit rules to this effect.[46]

Annex 2 CC44 established the rules of the air and prescribes that for air travel to be safe and efficient, a set of internationally agreed rules of the air is required. These rules consist of general rules, visual flight rules and instrument flight rules. Annex 2 provides the details to the rules established in Article 12 CC44. Article 12 prescribes that each contracting state undertakes to adopt measures to insure that every aircraft flying over or manoeuvring within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and manoeuvre of aircraft there in force. These rules apply also to remotely piloted aircraft.[47] It is noteworthy that Article 3.3 to Appendix 4 of Annex 2 CC44 mandates that 'unmanned balloons' must be equipped with at least two payload flight termination devices or systems. Some authors believe this requirement is also applicable to remotely piloted aircraft which would oblige the pilot-in-command to take action to best avert collision.[48] These authors conclude that "pilots flying according to instrument flight rules are required to scan the environment visually in order to detect potentially conflicting traffic". This is in fact one of the problems that SafeDroneWare seeks to resolve.

In light of the safety's crucial role, in 2011 ICAO released a circular entitled 'Unmanned Aircraft Systems (RPAS)' which aimed to apprise states of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes; consider the fundamental differences from manned aviation that such integration will involve; and encourage states to help with the development of ICAO policy on UAS by providing information on their own experiences associated with these aircraft.[49] ICAO relies on the

[46] Ibid., 125. A similar suggestion has also been made by ICAO in ICAO, 13.
[47] Abeyratne, *Convention on International Civil Aviation : A Commentary*, 125.
[48] Ibid., 126.
[49] ICAO, 2.

premise that unmanned aircraft are 'aircraft' per the convention's definition and as such all SARPs applicable to aircraft are also applicable to remotely piloted aircraft.[50] The circular is organised to reflect the three traditional areas of aviation: operations, equipment and personnel.

The circular solves the legal limbo created by the diverging interpretations of Article 8 CC44 by referring to Global Air Traffic Management Operational Concept (Doc 9854), which states that "[a]n unmanned aerial vehicle is a pilotless aircraft, in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous." In particular, the circular specifies that the intent of the convention's drafters in providing for "aircraft flown without a pilot" refers to a situation where there is no pilot on board the aircraft.[51] Furthermore, it provides that only remotely piloted aircraft will be able to integrate into the international civil aviation system in the "foreseeable future".[52]

The circular highlights the important role of the remote pilot in ensuring the safe and predictable operation of the aircraft interacting with other civil aircraft and the air traffic management system. The circular further clarifies that model aircraft are excluded from the scope of application of the convention. ICAO also confirms its commitment to keeping all terms in common use unchanged by the introduction of UAS. In particular, it highlights that the function of the pilot remains intact regardless of the fact that person or persons responsible are not on board the aircraft. The circular elucidates that the pilot-in-command shall be responsible as a pilot of a manned aircraft for detection and avoidance of potential collisions and other hazards.[53] Furthermore, it clarifies that in the foreseeable future no carriage of passengers on board will be allowed on board UAS. ICAO considers the ability of remotely piloted aircraft to respond and act in the way manned aircraft do a key factor in the safe integration of UAS in non-segregated airspace.

In light of Article 8 CC44, the circular emphasises that the pilot of the remotely piloted aircraft will have to comply with instructions provided by the state, including using electronic and visual means, and have the ability to divert to a specified airport at the state's request.[54] It further confirms that the rules of the air apply to all aircraft, regardless of whether they are manned or unmanned and that in accordance with Article 12 and Annex 2, the pilot-in-command is responsible for the operation of the aircraft in compliance with these rules. The circular also stresses on the importance of developing SARPs for remotely piloted aircraft. It encourages states to develop national regulations facilitating mutual recognition of certificates of unmanned aircraft.[55]

The circular highlighted the challenges of integrating remotely piloted aircraft into the existing system of certification. Some of the concerns relate to the fact that remotely piloted aircraft

[50] Abeyratne, *Convention on International Civil Aviation : A Commentary*, 127.
[51] ICAO, 11.
[52] Ibid., 3.
[53] Abeyratne, *Convention on International Civil Aviation : A Commentary*, 129.
[54] ICAO, 11.
[55] Ibid., 14.

cannot operate without supporting system elements, such as remote pilot station, command and control link etc., as well as due to the possibility for changing elements of the system. Other concerns refer to the issue of the possibility for locating the different components of the system in different states. In terms of airworthiness, the circular confirms that Article 31 and 33 CC44 are applicable to remotely piloted aircraft but may require further elaboration and interpretation in the context of the following issues:

- SARPs are limited to aircraft over 750 kg intended for carriage of passengers or cargo or mail;
- SARPs for remote pilot stations;
- Provisions for command and control (C2) data links.

The circular's purpose is to act as guidance for regulators and legislators in the adoption of national rules. However, until an international framework of rules and regulations is adopted, non-binding documents like this circular will only have a limited impact.

3. THE INTERNATIONAL LEGAL FRAMEWORK FOR LIABILITY FOR DAMAGES CAUSED BY REMOTELY PILOTED AIRCRAFT

In air law, the liability for damages is the subject of several international treaties dealing with second- and third-party liability. These will only briefly be analysed here since their applicability in the context of remotely piloted aircraft may depend on restrictions imposed in national law.[56]

Second-party liability

Second party liability deals with the liability of the carrier or operator for damage to passengers or cargo. This type of liability applies in cases based on an existing contractual link between the parties. At international level, the most recent legal instrument is the 1999 Convention for the Unification of Certain Rules for International Carriage by Air, known as the Montreal Convention, establishes some of the rules. Since it regulates "certain rules" only, it is not meant to unify extensively the second-liability regime.[57]

Article 1 of the Montreal Convention defines the scope of application relying on the criterion of 'internationality' of the activity. Thus, it applies to all international carriage of persons, baggage or cargo performed by aircraft for reward as well as to gratuitous carriage by aircraft performed by an air transport undertaking. The second paragraph of Article 1 clarifies that "international carriage" means "any carriage in which, according to the agreement between the parties, the place of departure and the place of destination, whether or not there be a break in the carriage or a transhipment, are situated either within the territories of two States Parties, or within the territory of a single State Party if there is an agreed stopping place within the territory

[56] This is the case with the Belgian law which explicitly prohibits certain operations with remotely piloted aircraft, including carriage of passengers and cargo.
[57] Mendes de Leon and Scott, 204.

of another State, even if that State is not a State Party". Finally, the text of Article 1 explicitly provides that carriage between two points within the territory of a single state party without an agreed stopping place within the territory of another state is not international carriage.

Based on the scope of application, the criteria for applicability of the Montreal Convention seem to be the following three:

- **The vehicle must be an aircraft**

It seems reasonable to assume that the term 'aircraft' will be construed in the meaning it has in CC44. Furthermore, the Montreal Convention, in its preamble, reaffirms the parties' desirability "of an orderly development of international air transport operations and the smooth flow of passengers, baggage and cargo in accordance with the principles and objectives of the Convention on International Civil Aviation". Thus, the elements of the definition, as elaborated above, will also be relevant in the context of the Montreal Convention.

- **The activity must be *international* carriage** (*emphasis added*)

The international element is crucial for the application of the Montreal Convention. Since many of the existing civil operations with remotely piloted aircraft are national, the likelihood of an operation falling within the ambit of this legal instrument seems to be low.

- **The carriage must be of persons, baggage or cargo**

Interpreted in line with ICAO's circular suggestions for the rate of adoption of remotely piloted aircraft in the near future, it seems unlikely that the convention will be applicable to activities involving carriage of persons any time in the foreseeable future. Some authors argue that the convention will still be applicable to cases involving carriage of cargo and that this is a market likely to grow.[58] While this seems to be indeed correct, some national legislators have taken quite a restrictive approach by prohibiting even operations involving carriage of cargo.[59]

In the cases where the Montreal Convention is applicable, the rules of Chapter III set out the liability of the carrier and extent of compensation for damage. However, many of these rules will need to be interpreted in light of the specifics of remotely piloted aircraft. Thus, the requirement of Article 17 that the liability of the carrier for "death or bodily injury of a passenger" is triggered upon condition only that the accident which caused the death or injury took place on board the aircraft or in the course of any of the operations of embarking or disembarking, is clearly not applicable in the context of remotely piloted aircraft. In comparison, the rules of Article 18 on liability for damages to cargo could be applicable since the condition that triggers their applicability refers to an event that takes place during the carriage by air.

It is apparent that a number of loopholes in the second-party liability regime cannot be closed only by means of interpretation. The Montreal Convention will likely have to revised and complemented as remotely piloted aircraft gain larger market shares in the years to come.

[58] Ibid.
[59] Cf. Article 6 (3) of the Belgian Royal decree on the use of remotely piloted aircraft in Belgian airspace.

Third-party liability

At international level, third-party liability is the subject of the 1952 Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, commonly known as the Rome Convention. This convention lays down the international rules for compensation for persons who suffer damage caused on the surface by foreign aircraft.

Article 1, paragraph 1 of the Rome Convention stipulates that "any person who suffers damage on the surface shall, upon proof only that the damage was caused by an aircraft in flight or by any person or thing falling therefrom, be entitled to compensation as provided by this Convention. Nevertheless, there shall be no right to compensation if the damage is not a direct consequence of the incident giving rise thereto, or if the damage results from the mere fact of passage of the aircraft through the airspace in conformity with existing air traffic regulations".

The criteria for 'activating' the convention's rules on liability could be summarised, as follows:

- A person must suffer damage;
- The damage should occur on the surface;
- The damage must be caused by an aircraft in flight or by any person or thing falling therefrom;
- The damage must be caused by an aircraft in another signatory state of the convention;
- The damage must be a direct consequence of the incident which has given rise to it.

The convention apparently mandates the cumulative action of all the elements in order to apply to a particular situation. The convention's impact is severely diminished due to the fact that it does not have a universal application and major countries, such as the USA and China, are not signatories to it.

The convention could also be criticised for its unclear rules on the identification of the aircraft's operator.[60] Thus, Article 2(1) attached the liability for compensation to the operator, who is defined in paragraph 2 as "the person who was making use of the aircraft at the time the damage was caused, provided that if control of the navigation of the aircraft was retained by the person from whom the right to make use of the aircraft was derived, whether directly or indirectly, that person shall be considered the operator". Arguably, in cases of commercial exploitation the operator will be the legal person and not its employees. The case is more difficult in the scenario of recreational use where the person who has control of the aircraft's navigation could change multiple times. As some national laws have mandated the registration of remotely piloted aircraft, it will arguably become easier to identify the operator; however, the issue is still likely to be present in the context of damage caused by an aircraft in another signatory state of the Rome Convention.

Given the limited scope of the convention and the difficulties in its application, it is to be expected that recourse to the national rules on tortious and product liability will often have to be made in these cases.

[60] Mendes de Leon and Scott, 205.

4. CONCLUSION

The overview of the international safety legal framework shows that there are multiple rules which could be successfully construed and applied in the context of both manned and unmanned aviation. However, ICAO has properly recognised the need of specific SARPs to take into account the specifics of remotely piloted aircraft. Furthermore, even though the public international framework can be complemented with new rules on safety by means of SARPs and other 'soft' measures, the same cannot be said about the rules that deal with issues of private international law, such as liability for damages. Against this background, the EU seems to be sitting in a favourable position because of EASA and European Commission's recent efforts to extend the concept of a 'Single European Sky'[61] to cover remotely piloted aircraft.

[61] http://www.eurocontrol.int/dossiers/single-european-sky

CHAPTER II

RECENT DEVELOPMENTS AT EU LEVEL IN THE FIELD OF SAFETY OF UNMANNED AVIATION

This chapter discusses the recent developments in the EU that concern the safety rules for remotely piloted aircraft. While it is mainly focused on the rules of the existing legal framework, this chapter also touches upon some recent initiatives of EASA and the European Commission. It discusses the importance of common legal rules at EU level for the successful 'take-off' of unmanned aviation and how the existing barriers might hinder the commercial success of these technologies.

1. OVERVIEW OF RECENT POLICY INITIATIVES IN THE EU

The European Commission foresees that within 20 years, the European drone sector will "directly employ more than 100 000 people" and will have an "economic impact exceeding €10 billion per year, mainly in services".[62] The Commission also recognised the need of European safety rules for civil drones. Thus, its efforts have resulted in the adoption of a proposal for the revision of EASA Basic Regulation 216/2008 on 8 December 2015[63] to cover the elements necessary to enable the development of safety rules for remotely piloted aircraft. EASA also took initiative by publishing a draft of Commission implementing rules as a 'Prototype' Commission Regulation on Unmanned Aircraft Operations[64] and its Explanatory Note[65]. These rules are based on a Technical opinion on the operation of drones[66], published in 2015, as well as on a Concept of Operations for Drones[67] and a Proposal to create common rules for operating drones in Europe[68].

The initiatives at EU level date back to 2013 when the European RPAS Steering Group published a final report entitled 'Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System'.[69] The roadmap highlighted the importance of

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[62] European Commission, Unmanned aircrafts, available at: http://ec.europa.eu/growth/sectors/aeronautics/rpas_en, last accessed: 10th March 2017.
[63] Available at: http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52015PC0613, last accessed: 21 March 2017.
[64] Available at: https://www.easa.europa.eu/system/files/dfu/UAS%20Prototype%20Regulation%20final.pdf, last accessed: 21 March 2017.
[65] Available at: https://www.easa.europa.eu/system/files/dfu/Explanatory%20Note%20for%20the%20UAS%20Prototype%20regulation%20final.pdf, last accessed: 21 March 2017.
[66] Available at: https://www.easa.europa.eu/system/files/dfu/Introduction%20of%20a%20regulatory%20framework%20for%20the%20operation%20of%20unmanned%20aircraft.pdf, last accessed: 21 March 2017.
[67] Available at: https://www.easa.europa.eu/system/files/dfu/204696_EASA_concept_drone_brochure_web.pdf, last accessed: 21 March 2017.
[68] Available at: https://www.easa.europa.eu/system/files/dfu/205933-01-EASA_Summary%20of%20the%20ANPA.pdf, last accessed: 21 March 2017.
[69] Available at: http://ec.europa.eu/DocsRoom/documents/10484/attachments/1/translations/en/renditions/native, last accessed: 21 March 2017.

harmonised rules at European level for the promotion of safety for citizens and improving the development of the internal EU market.

In 2014, the European Commission published a Communication from the Commission to the European Parliament and the Council, entitled 'A new era for aviation. Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner'.[70] The Commission recognised that remotely piloted aircraft form part of a wider category of unmanned aerial systems which also include systems capable of autonomous flights. Thus, the Commission explicitly clarified that its efforts are directed towards aircraft that are "controlled by a pilot from a distance".[71] The Commission argued that remotely piloted aircraft should be able to fly as part of the system involving 'normally piloted' aircraft, ie, in non-segregated airspace. The European strategy on remotely piloted aircraft aims to create a single market for remotely piloted aircraft but admits that this would only be possible if these aircraft are integrated into the wider civil aviation system. The strategy reveals several objectives:

- ***Safety***. The integration of remotely piloted aircraft into the aviation system should not compromise safety. The regulatory framework should consider the variety of aircraft and operations to keep the rules "proportionate to the potential risk and contain administrative burden for industry and for the supervisory authorities".[72] EASA is recognised as "best placed" to develop common rules. The Communication argued that EASA's restricted competence to unmanned aircraft above 150 kg based on classical airworthiness considerations should be reconsidered as it seems 'arbitrary'. The rules should be compatible with ICAO standards and should be proportionate to risk. They should consider, among others, the weight, speed, complexity, airspace class and place of specificity of operations. The communications further argues that the traditional process of airworthiness certification should be complemented by 'light touch' forms of regulation.
- ***Safe operation into non-aggregated airspace: enabling technologies.*** The Commission highlighted that certain technologies need development and validation, incl. command and control (incl. spectrum allocation and management), detect and avoid technologies, security protection against physical, electronic or cyber-attacks, transparent and harmonised contingency procedures, decision capabilities to ensure standardised and predictable behaviour in all phases of flight; and human factor issues, eg, piloting.
- ***Ensure security of operations.*** The potential use of remotely piloted aircraft as weapons, the risk of 'jamming' the navigation or communication signals of other aircraft or the hijacking of remote pilot stations are all seen as major security risks. The Commission laid emphasis on the importance of properly addressing the security aspects in order to avoid unlawful interference and to encourage manufacturers and operators to consider security mitigating measures.

[70] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014DC0207, last accessed: 21 March 2017.
[71] Ibid. 2.
[72] Ibid. 5.

- ***Fundamental rights protection.*** Citizens' fundamental rights should not be infringed by the operation of remotely piloted aircraft. In particular, the Commission points to the right to private and family life and the right to personal data protection. It is also noted that in terms of privacy and data protection, most commonly the risks concern the installation of surveillance equipment on board the aircraft. The Commission identified the need of expert consultations, awareness rising and promotion measures under national competence.
- ***Guaranteeing third party liability and insurance***. The parties liable for damage should be easily identifiable and should be able to meet their financial obligations. The Commission noted that the existing third-party insurance regime is designed for operations of manned aircraft where the take-off mass starts from 500 kg and is used as a main criterion to determine the minimum amount of insurance. The Commission undertook to assess the existing liability regime and third-party insurance requirements in order to ensure that the risks relating to operations of remotely piloted aircraft are properly addressed.
- ***Supporting market development and European industries***. The Commission also undertook to promote the development of remotely piloted aircraft applications in a wide range of sectors, to stimulate innovation and foster the creation of cross-sectoral value chains. The aim is to define specific actions to support the development of this nascent market.

Following the Commission's Communication of 2014, in March 2015, in Riga, Violeta Bulc, EU Commissioner for Mobility and Transport, summarised the main principles to guide the regulatory allowing civil operations of remotely piloted aircraft throughout Europe. The Riga Declaration[73] formulated the following main principles:

- ***Drones need to be treated as new types of aircraft with proportionate rules based on the risk of each operation***. Rules should be simple and performance based.
- ***EU rules for the safe provisions of drone services need to be developed now***. They should be harmonised at the global level as much as possible.
- ***Technologies and standards need to be developed for the full integration of drones in European airspace***. There is a need for adequate investment in the technologies required to integrate them into the aviation system – SESAR programme.
- ***Public acceptance is key to the growth of drones services***. Citizens' fundamental rights need to be guaranteed. Guidelines and monitoring mechanism should be developed to ensure the full respect of existing protection rules.
- ***The operator of the drone is responsible for its use***. It will also be necessary to ensure that drones have an identifiable owner or operator. Also, the insurance and third-party liability regime should be clarified by Member States and reporting of drone accidents should be "integrated into the overall incident reporting requirements".[74]

[73] Available at: http://ec.europa.eu/transport/sites/transport/files/modes/air/news/doc/2015-03-06-drones/2015-03-06-riga-declaration-drones.pdf, last accessed: 21 March 2017.
[74] Ibid. 5.

In May 2015, EASA published a 'Concept of Operations for Drones. A risk based approach to regulation of unmanned aircraft'. This document argued for the creation of a "proportionate, progressive, risk based" system of rules for drones. It was argued that these rules must express objectives that are to be complemented by industry standards and that the regulatory framework should set a level of safety and environmental protection acceptable to society but also offering flexibility and adaptiveness.[75] This concept suggested three categories of drone operations and their associated regulatory regime: open, specific and certified. The concept of operations identified several important safety risks that need to be considered[76], namely:

- Mid-air collision;
- Harm to people;
- Damage to property, in particular critical and sensitive infrastructure.

Following the concept of operations, in September 2015, EASA published a 'Proposal to create common rules for operating drones in Europe'. The proposal suggested the creation of common European safety rules for operating drones regardless of their weight. It highlighted that the existing regime requires that drones with a take-off mass above 150 kg are regulated in a way similar to other aircraft in manned aviation. Drones with a take-off mass below 150 kg are therefore regulated by each Member State in accordance with its national legislation. This, however, creates a risk for fragmentation of the market and short-sighted vision since weight is not the only relevant criterion. EASA suggested the adoption of common safety rules in Europe regardless of the drones' weight. The approach was termed 'proportional and operation-centric'. This new line thus suggests turning the focus from the characteristic of the drone itself to the conditions and the manner in which the drone is used. With this document, EASA made 33 specific proposals. Among others, these proposals suggested regulation of commercial and non-commercial operations as the same drone may be used for both commercial and non-commercial activities. They also highlighted the importance of establishing the three categories of operation of drones as proposed in the concept of operations. In particular, the proposal suggested the following:

- *Open category*, which presents low risk and where safety is ensured through operations limitations, compliance and industry standards, and the requirement to have certain functionalities and a minimum set of operational rules. In this category, enforcement is expected to be carried out mainly by the police.
- *Specific category* (medium risk), where an authorisation by a national aviation authority is required and which is assisted by an organisation which may be allocated a specific certification task (Qualified Entity, QE), following a risk assessment carried out by the operator.
- *Certified category* (high risk), where the requirements are comparable to those for manned aviation. In this case, oversight by the national aviation authority and by EASA will likely be involved.

[75] Available at: https://www.easa.europa.eu/system/files/dfu/204696_EASA_concept_drone_brochure_web.pdf, last accessed: 21 March 2017.
[76] As will be shown in the following chapter, these safety risks have been well-recognised by national legislators as well.

The proposals also suggested designation of responsible authorities for the enforcement of the regulations in EASA Member States and exclusion of the 'open' and 'specific' categories from the EU aviation system. Furthermore, it was proposed that the Member States be given local-level flexibility without being subject to oversight on the part of EASA and that procedures be established for approval and audit of QEs by the national aviation authorities or EASA to make sure they adhere to common rules. Finally, the proposal then specified details concerning the three categories. Since this document has further been superseded by other documents, it will not be further analysed here. However, it is important to note that it suggested the creation of a three-category classification of drones based on the operations and not on their weight.

In December 2015, EASA published a 'Technical Opinion. Introduction of a regulatory framework for the operation of unmanned aircraft'. This opinion was the result of the 'Proposal to create common rules for operating drones in Europe' and was developed in parallel to the amendments to the Basic Regulation. It included 27 proposals for a regulatory framework and for low-risk operations of unmanned aircraft regardless of their take-off mass. The opinion once again highlighted the new framework is based on the principles of operation-centric, proportional, risk- and performance-based rules. As a technical opinion, the draft did not include any legal texts and will thus not be analysed in detail here.

In November 2016, the Polish Minister of Infrastructure and Construction Andrzej Adamczyk hosted the Warsaw High Level Conference also attended by European Commissioner Violeta Bulc, the Executive Director of EASA Mr Patrick Ky, the acting President of the Polish CAA Mr Piotr Samson, the Executive of the SESAR Joint Undertaking Director Florian Guillermet, a number of Directors General of Civil Aviation from the EU Member States, representatives of ICAO, international associations, European bodies, Agencies, together with leaders of the industry.[77] The conference called for several coordinated actions to develop an EU drone ecosystem to be delivered before 2019. The Warsaw Declaration, entitled 'Drones as a leverage for jobs and new business opportunities', summarised these actions, as followed:

- EASA should further the interaction between drones and manned aircraft.
- A simple-to-use, affordable, commercially and operationally friendly drone ecosystem should be developed, capable of addressing all societal concerns such as safety, security, privacy and environmental protection.
- Safety rules should be developed that are simple, proportionate to the risk of the operation, performance-based, future-proof, and based on global standards. Industry should aim to develop open standards to support performance-based regulation.
- There is a need for urgent action on the airspace dimension, ie the development of the concept of 'U-Space' on access to low level airspace, especially in urban areas.
- The whole EU drone community should participate in demonstrators to test as rapidly and as effectively as possible the feasibility of the requirements and standards of the U-Space.

[77] Available at: https://ec.europa.eu/transport/modes/air/european-unmanned-aircraft-systems-uas/warsaw-declaration_en, last accessed: 21 March 2017.

- There is a need to tackle security issues and to enhance the cooperation between security, defence and safety actors.
- There is a need to promote education and safety to increase actors' awareness, especially those without an aviation background.
- An effective coordination mechanism between the Commission, the relevant European agencies, and stakeholders to reflect on the drone services market and to monitor, advise and assist with the establishment of a regulatory framework, efficacy and funding of drone integration projects, and development of U-Space.

In January 2017, EASA announced its Rulemaking and Safety Promotion Programme 2017-2021.[78] The programme. One of the programme's strategic priorities is to ensure the safe operation of drones.[79] The programme recognised that the lack of harmonised rules at EU level makes unmanned aircraft systems operations dependent on an individual authorisation by each Member State. It suggested that obviating the administrative burden and restrictions will encourage companies to make best use of these technologies. Furthermore, the programme highlighted that "consistent requirements and expectations will help manufacturers design for all conditions and ease compliance with requirements by operators".[80] The programme also recognised the impact of security and safety and emphasised that the multiplication on network connections increase the whole system's vulnerability. The ultimate goal is to create a level playing field in all EU Member States. Relying on an operation centric concept, proportionate and risk- and performance-based, it aims to encourage investment and innovation while maintaining a high level of safety across Member States.[81] Specific actions outlined by the Rulemaking and Safety Promotion Programme 2017-2021 include development of rules for three categories of unmanned aerial systems based on EC communication COM(2015)613 and the proposals to amend the Basic Regulation.[82]

2. LEGISLATIVE PROPOSALS AT EU LEVEL

In terms of legislation at EU level, the existing framework comprises:

- Regulation 216/2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency (Basic Regulation)
- Regulation (EC) No 549/2004 of the European Parliament and of the Council laying down the framework for the creation of the single European sky
- Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community
- Regulation (EC) No 785/2004 of the European Parliament and of the Council of 21 April 2004 on insurance requirements for air carriers and aircraft operators

[78] Available at: https://www.easa.europa.eu/system/files/dfu/RMP-EPAS_2017-2021.pdf, last accessed: 21 March 2017.
[79] Ibid. 10.
[80] Ibid. 11.
[81] Ibid. 55.
[82] Ibid. 56.

The Basic Regulation governs remotely piloted aircraft with take-off mass above 150 kg subject to authorisation by EASA. In particular, Annex II to the regulation, in connection with Article 4(4), clarifies that Article 4(1), (2) and (3) do not apply to aircraft falling in one or more of the categories set out below: (i) unmanned aircraft with an operating mass of no more than 150 kg. Thus, it follows that unmanned aircraft with an operating mass of less than 150 kg are not subject to regulation at EU level under the existing regime.

Proposal for a new Basic Regulation

In 2016, the European Commission published the Proposal for a Regulation of the European Parliament and of the Council on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and repealing Regulation (EC) No 216/2008 of the European Parliament and of the Council. The proposal abandons the requirement for 150 kg operating mass and shifts the focus to the inherent risk of a particular operation. It also highlights that unmanned aircraft will become another type of aerial vehicle to provide a range of new services in the European aviation market within the context of Regulation (EC) 1008/2008 on common rules for the operation of air services in the Community. Furthermore, it explicitly places unmanned aircraft under the overall aviation policy as they will share the same space with other aircraft which also requires that their operations are consistent with air traffic rules as laid down in the Common Rules of the Air.

In line with the principle of subsidiarity, the proposal clarifies that Member State authorities will carry out local risk assessments and decide which airspace shall be open or closed to unmanned aircraft operations, and under which conditions. At the same time, it stipulates that most of the light unmanned aircraft operations have a local dimension and it should be for the local authorities to assess the level of risk and authorise the specific type of operation.

The proposal introduces new definitions that are key to understanding the scope of regulation. The provision of Article 3 (29) defines unmanned aircraft as ‘any aircraft operated or designed to be operated without a pilot on board’. Article 3 (30) defines ‘equipment to control unmanned aircraft remotely’ as “any equipment, apparatus, appurtenance, software or accessory that is necessary for the safe operation of an unmanned aircraft”. Article 3 (32) defines ‘state aircraft’ as “aircraft when carrying out military, customs, police, search and rescue, firefighting, coastguard or similar activities or services under the control and responsibility of a Member State, undertaken in the public interest by a body vested with public authority powers”.

Article 2 of the proposal introduced the possibility for Member States to apply certain provisions of the new Regulation to activities and services performed by state aircraft. The opt-in regime concerns customs, police, search and rescue, firefighting, coastguard or similar activities or services, as well as ATM/ANS provided by the military.

Article 45-47 of the Proposal contain the legal basis for more detailed rules on unmanned aircraft. Particularly, Article 45 refers to Annex IX which provides the essential requirements about the design, production, operation and maintenance of unmanned aircraft that need to be complied with to ensure safe operations. Article 46 specifies the means required to demonstrate that the essential requirements are met. The range of risks associated with unmanned aircraft operations is very wide compared to traditional, manned aviation. They could range from the

traditional high risk operations similar to 'manned aviation risks' to very low risk. The proposal claims it is necessary to move towards an operation centric approach that assesses the exact risk of an operation or of a type of operations. This is required to keep the rules and procedures proportionate to the risk of the operation.

The proposal also addresses mass produced unmanned aircraft which pose a low risk. It provides that these should be subject to market surveillance in accordance with Regulation 765/2008 and Decision 768/2008. Aviation authorities will nevertheless remain involved since the operational capacity limitations likely to be imposed will stem directly from traditional aviation requirements.

The proposal also considers the implications of unmanned aircraft for fundamental rights. It provides that the "rules regarding unmanned aircraft should as much as possible contribute to achieving compliance with relevant rights guaranteed under Union law, in particular the right to respect for private and family life, as set out in Article 7 of the Charter of Fundamental Rights of the European Union, and with the right to protection of personal data, as set out in Article 8 of that Charter and in Article 16 of the Treaty on the Functioning of the European Union and as regulated in Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data" (Recital 19).

Even though the adopted definition of 'unmanned aircraft' is very broad and could cover both autonomous and remotely piloted aircraft, the systemic interpretation of this provision with the definition of 'equipment to control aircraft remotely' of Article 3 (30), Articles 45-47, Annex IX and Communication from the Commission to the European Parliament and the Council of 2014 all seem to indicate undoubtedly that the proposal does not make an attempt to bring fully autonomous flights within its ambit.

Since the proposal is subject to change, no decisive comments could be made at this stage about the potential impact of these rules on the industry.

EASA 'Prototype' Commission Regulation on Unmanned Aircraft Operations

In 2016, EASA announced a 'Prototype' Commission Regulation on Unmanned Aircraft Operations. The envisaged legal basis for the adoption of this regulation is the proposed new Basic Regulation. Pursuant to this proposal and the 'prototype' regulation, EASA is vested with the power to adopt Commission acts for the design, production, maintenance and operation of unmanned aircraft systems and their engines, propellers, parts, non-installed equipment and equipment to control them remotely.

EASA proposed the regulation as a 'prototype' in order to "reflect the fact that they [Member States] should help preparing the formal rulemaking process that will follow".[83] The rationale

[83] EASA, Explanatory Note on 'Prototype' Commission Regulation on Unmanned Aircraft Operations, available at: https://www.easa.europa.eu/system/files/dfu/Explanatory%20Note%20for%20the%20UAS%20Prototype%20regulation%20final.pdf, p. 5, last accessed: 21 March 2017.

of the proposal is to "gather reactions which will be used to develop the necessary Notice of Proposed Amendments".[84]

Recital 2 of the 'prototype' regulation reinforces the premise that measures should be proportionate to the nature and risk of the type of unmanned aircraft operation and should in particular take due account of the type of operation and whether the operation is open to members of the public; the extent to which other air traffic or persons and property on the ground could be endangered by the operation; the type of airspace used and territory overflown; the complexity and performance of the aircraft involved; the type, scale, and complexity of the operation or activity, including, where relevant, the size and type of the traffic handled by the responsible organisation or person. The Explanatory Note to the 'Prototype' Regulation confirms that the consequences of a loss of control of an unmanned aircraft is "highly dependent on the operational environment".[85]

Article 3 of the 'prototype' regulation lists the categories of unmanned aircraft operations. It follows the three-category approach: (1) open category; (2) 'specific' category; and (3) 'certified' category. Also, the 'prototype' regulation states the principles for unmanned aircraft operations in Article 4. The regulation provides that the operator of an unmanned aircraft shall be responsible for its safe operation and that they should comply with the requirements of the regulation and other applicable regulations, in particular those related to security, privacy, data protection, liability, insurance and environmental protection. The regulation also provides for a registration procedure with the competent authority, mandatory displaying of registration marks, equipping the aircraft with electronic identification means.[86]

For operations in the 'open' category, which do not require a prior authorisation by the competent authority, Article 5 and Annex I set out the requirements include a combination of safety measures such as requirements and limitations set by the regulation, limitations defined by the competent authority for geofencing[87] purposes or for particular airspace areas etc. The open category is further divided into subcategories depending on the different levels of risk.

For operations in the 'specific' category, a prior authorisation by the competent authority is required, and it should take into account the mitigation measures identified in an operational risk assessment. As an exception to this rule, in certain 'standard scenarios'[88] a declaration by the operator is sufficient.

For operations in the 'certified' category, a certification of the aircraft is required, as well as a licenced remote pilot and an operator approved by the competent authority in order to ensure

[84] Ibid.
[85] EASA, 'Prototype' Commission Regulation on Unmanned Aircraft Operations, p. 3, available at: https://www.easa.europa.eu/system/files/dfu/UAS%20Prototype%20Regulation%20final.pdf, last accessed: 21 March 2017.
[86] 'Electronic identification' is defined in Article 2(2)(f) as "the capability to identify a UA in flight without direct physical access to that aircraft".
[87] 'Geofencing' is defined in Article 2(2)(j) as "an automatic function to limit the access of the UA to airspace areas or volumes provided as geographical limitations based on the UA position and navigation data". 'Geographical limitations' are defined in Article 2(2)(i) as "restricted airspace volume defined through electronic map data".
[88] The Explanatory Note clarifies that EASA will publish these scenarios based on the performance of risks assessments for specific type of flights or specific operations, such as infrastructure inspection (p. 11).

an appropriate level of safety. These requirements are comparable to those for manned aviation and the roles played by EASA and the national aviation authorities are significant.

The regulation introduces the concept of 'safety-critical services' (Article 7) and provides a non-exclusive list of services which may be considered 'safety-critical'. These include: providing geographical data and limitations; collecting and forwarding occurrence data; the training of pilots. Any provider of such services is responsible for the accuracy and integrity of the provided information and data, and for the quality of the services. These are demonstrated by a suitable organisational structure, appropriate documented procedures, and adequate resources and personnel.

The regulation entrusts the competent authorities with the task of defining airspace areas or special zones where unmanned aircraft operations are not permitted without prior authorisation or are not permitted at all; where unmanned aircraft shall comply with defined technical or performance specifications, including mandatory equipment or functions that enable easy identification or automatically limit the airspace they can enter (geofencing); and where unmanned aircraft operations shall comply with specified environmental standards.

The annexes to the regulation provide very detailed requirements for the different categories and subcategories of unmanned aircraft operations. Since these are, however, only proposals, no conclusive analysis or recommendations based on them could be made at this stage.

3. STANDARDISATION

While the current legislative proposals are all aimed at ensuring a high level of safety while encouraging investment and innovation, safety might still be at risk if no sufficiently stable and precise standards are mandated.

In the Explanatory Note to the 'Prototype' Regulation, EASA noted that it is already participating in the RPAS panel of ICAO as well as in JARUS.

JARUS is an expert group comprising representatives of the national aviation authorities (NAAs) and regional aviation safety organizations. It aims at creating and recommending a single set of technical, safety and operational requirements for the certification and safe integration of unmanned aircraft systems into airspace and at aerodromes. JARUS' objective is to provide guidance material aimed at facilitating each authority to write their own requirements and to avoid duplicate efforts.[89]

JARUS is composed of six Working Groups, as follows:

- WG 1 'Operational and Personnel Requirements (OPS)';
- WG 2 'Operations (OPS)';
- WG 3 'Airworthiness (AW)';
- WG 4 'Detect and Avoid (DA)';
- WG 5 'Command, Control and Communication Group (C3)';

[89] More information is available at: http://jarus-rpas.org/, last accessed: 21 March 2017.

- WG 6 'Safety & Risk Management'

Recently, JARUS has published the following documents of relevance to the standardisation of unmanned aircraft operations:

- Certification Specification for Light Unmanned Rotorcraft Systems;[90]
- Guidance material to explain the concept of C2 link RCP and identify the requirements applicable to the provision of C2 communications;[91]
- Recommendations concerning uniform personnel licensing and competencies in the operation of RPAS;[92]
- Recommendations for States to use for their own national legislation, concerning Certification Specification for Light Unmanned Aeroplane Systems.[93]

Existing studies have recognised the need of developing standards for identification of the unmanned aircraft, pilot competencies, data link security etc. Standardisation of unmanned aircraft operations is no less critical than it is for manned aviation. Thus, the coordinated action of ICAO, EASA, JARUS and the national aviation authorities will be of crucial importance in this regard.

4. CONCLUSIONS

The brief overview of the existing policy and legislative initiatives at EU level clearly demonstrate that unmanned aircraft operations are high on the agenda. However, two critical remarks could be made. First, the slow process of rulemaking has stalled the initial ambition of integrating unmanned aircraft into non-segregated airspace by 2016. Second, the absence of rules have forced many countries to consider national legislation governing all types of operations. While the guidance of ICAO has certainly influenced this process, national legislations could provide for different regimes for one and the same operations, or mandate different requirements or impose significant restrictions. The effect of these diverging approaches is that the market's fragmentation is slowly progressing. The absence of uniform rules at EU level is stifling innovation and restrictive national rules act as disincentives for manufacturers and commercial actors to take steps towards producing and commercial exploitation of unmanned aircraft. While some of these issues will be overcome by the reform of the Basic Regulation and the adoption of delegated acts by the European Commission, the impact of existing national rules on the development of this nascent market is yet to be evaluated.

[90] Available at: http://jarus-rpas.org/sites/jarus-rpas.org/files/storage/Library-Documents/jar_01_doc_jarus_certification_specification_for_lurs_-_30_oct_2013.pdf, last accessed: 21 March 2017.

[91] Available at: http://jarus-rpas.org/sites/jarus-rpas.org/files/storage/Library-Documents/jar_02_doc_jarus_rpas_c2_link_rcp_-_10_oct_2014_1.pdf, last accessed: 21 March 2017.

[92] Available at: http://jarus-rpas.org/sites/jarus-rpas.org/files/jar_03_doc-fcl_0.pdf, last accessed: 21 March 2017.

[93] Available at: http://jarus-rpas.org/sites/jarus-rpas.org/files/jar_05_doc_cs-luas_v0_3.pdf, last accessed: 21 March 2017.

CHAPTER III

THE CASE OF BELGIUM: RULES ON REMOTELY PILOTED AIRCRAFT

This chapter focuses on the place of the recently adopted Royal Decree on the use of remotely piloted aircraft in Belgian airspace in the general aviation legal framework of Belgium. In the context of SafeDroneWare, this chapter will discuss the structure of the decree, focusing on the sections of importance to ensuring the safe operation of an unmanned aircraft. It will critically analyse the requirements of the royal decree in light of the recent policy and legislative initiatives at EU level. The chapter will particular focus on the level of autonomy allowed by the royal decree and will argue that the balance between safety and autonomy is critical to the success of commercial unmanned aviation.

1. GENERAL AVIATION LEGAL FRAMEWORK

In Belgium, the regulation of air traffic navigation falls within the federal competencies.[94] The legal framework comprises a set of laws and royal decrees that have different relationship with the recently adopted Royal Decree on the use of remotely piloted aircraft in Belgian airspace. These legal instruments will be briefly discussed in the following paragraphs in order to outline the general framework within which the Royal decree on the use of remotely piloted aircraft in Belgian airspace operates.

1.1. Loi du 27 juin 1937 portant révision de la loi du 16 novembre 1919 relative à la réglementation de la navigation aérienne

The main legal instrument in the field is the *Law of 27 June 1937 revising the Law of 16 November 1919 concerning the regulation of Navigation in the Air*. This law stipulates in Article 2 that "the navigation of national aircraft above the territory of the Kingdom is free, except for the restrictions provided for by this act and these that will be enacted by royal decrees".[95]

Since the regulated matter is one of public interest and largely falls into the domain of public law, it has rightly been pointed out in literature that the fact that for a long period of time no royal decree has been governing the operations of remotely piloted aircraft does not mean they have been allowed. To the contrary, the lack of specific regulation implies that the utilisation of remotely piloted aircraft has been largely prohibited.[96]

1.2. Arrêté royal du 15 mars 1954 réglementant la navigation aérienne pour toute exploitation commerciale de la navigation aérienne

[94] Maxime Vanderstraeten; Sebastian Riger-Brown, "L'usage Des Drones Civils Enfin Réglementé – Bref Survol De L'arrêté Royal Du 10 Avril 2016," *Journal des tribunaux*, no. 31 (2016): 547.
[95] In French : « La circulation des aéronefs nationaux au-dessus du territoire du Royaume est libre, sauf les restrictions résultant de la présente loi et celles qui seront édictées par arrêté royal. »
[96] See in the same sense Riger-Brown, 547.

The *Royal Decree of 15 March 1954 regulating air transport* provides in Article 46 that the operation of scheduled air services is subject to a prior authorisation by the Minster responsible for aeronautical administration or his delegate. Furthermore, Article 47 stipulates that the operation of non-scheduled air transport is subject to the issuance of a prior operating permit by the Minister responsible for aeronautical administration or his delegate. Thus, it follows that all commercial operations of a remotely piloted aircraft have been prohibited prior to the adoption of the royal decree of 2016. In the absence of any kind of legal rules regulating the certification of remotely piloted aircraft, it would not have been possible for the DGTA to issues an operating permit. Reportedly, the DGTA has not issued any operating permits save for cases of test flights and for scientific purposes.[97]

Against this background and the pressing requests from industry, in 2016, a new legal instrument was adopted to explicitly regulate the operations of remotely piloted aircraft.

1.3.Arrêté royal du 10 avril 2016 relatif à l'utilisation des aéronefs télépilotés dans l'espace aérien belge

The *Royal decree of 10 April 2016 on the use of remotely piloted aircraft in Belgian airspace* was adopted on the basis of the Law of 27 June 1937 revising the Law of 16 November 1919 concerning the regulation of Navigation in the Air. It entered into force on the 25th April 2016.

The scope and the detailed rules provided for by the royal decree will be analysed in the next parts of this chapter.

1.4.Arrêté ministériel du 3 août 1994 fixant les conditions de délivrance des licences d'exploitation aux transporteurs aériens

The *Ministerial decree of 3 August 1994 laying down the conditions for the issuance of operating licences to air careers* is also issued on the basis of the Law of 27 June 1937 revising the Law of 16 November 1919 concerning the regulation of Navigation in the Air.

The decree does not contain any specific provisions concerning remotely piloted aircraft. Thus, the absence of any such provisions to this effect, similarly to the case with the Royal decree of 15 March 1954 regulating air transport, means that operations of remotely piloted aircraft have been prohibited before the adoption of the royal decree of 2016.

1.5.Arrêté royal du 19 décembre 2014 relatif aux règles de l'air et aux dispositions opérationnelles relatives aux services et procédures de navigation aérienne

The *Royal decree of 19 December 2014 implementing the common rules of the air and operational provisions regarding services and procedures in air navigation* provides for the adoption of rules regarding recreational use of remotely piloted aircraft. Thus, Article 18, § 1 (3) lists a number of operations that are subject to ministerial authorisation, such as the development of engines capable of damaging an aircraft, ie *remotely controlled spacecraft*.

Article 18 of the Royal decree of 19 December 2014 implementing the common rules of the air and operational provisions regarding services and procedures in air navigation is the legal

[97] Ibid.

ground for the adoption of *Circulaire CIR/GDF01 du 1er juin 2005*. This ministerial circular governs the use of model aircraft (remotely controlled aircraft). It restricts the use of model aircraft to certain terrains suitable for aeromodelling approved by the DGTA. Thus, before the adoption of the Royal decree of 2016, the use of remotely piloted aircraft for recreational purposes, even on private land, was prohibited.

1.6.Décret du 21 octobre 1997 concernant la conservation de la nature

In addition to the rules on safety established by the general aviation framework in Belgium, several legal instruments deal with aspects of environmental protection. These provisions could be relevant to the operation of remotely piloted aircraft. The relevant provisions from the Decree of 21 October 1997 regarding the preservation of nature are contained in Articles 32, 33 and 35.

Article 32, paragraph 1 prescribes that the Flemish government may designate or approve, as a nature reserves, land of importance for the preservation and development of nature or for the preservation and development or the natural environment. Article 33, paragraph 1 specifies that a Flemish nature reserve is a protected zone designated by the Flemish government for the lands owned or rented by the Flemish region or made available for this purpose. The second paragraph further defines "protected nature reserve" as a protected area not referred to in the first paragraph which is approved by the Flemish government at the request of the owner and/or the holder of the right to use, with their consent or that of the manager (*gestionnaire*), if the owner agrees. The third paragraph clarifies that in areas of open space, forest areas, forest extension zones or V.E.N, each nature reserve may be subject to an extension zone in which the right of pre-emption is applicable in accordance with Article 37 (on acquisition).

Finally, according to Article 35, § 2 (12), in nature reserves, unless approved by an approved management plan, it is prohibited to fly over the ground at low altitude or to land there with aircraft, helicopters, balloons and other *aircraft of any kind*. The last preposition refers to any kind of aircraft which implies that remotely piloted aircraft, subject to the Royal decree of 2016, make no exception.

1.7.Ordonnance relative aux déchets Ord./B. 1 mars 2012

The ordinance of 1 March 2012 on waste also contains relevant provisions on environmental protection. Thus, Article 3 (20), (21), (23) define terms such as 'special zone of preservation', 'special zone of protection', and 'Brussels ecological network'. These provisions include the scope of protection sites designated under the Natura 2000 programme.

The provision of Article 27, § 1 (26) prohibits flying over the ground at low altitude, taking off and landing of planes, helicopters, balloons and other aircraft of any kind as well as the release of kerosene, except when in distress. The prohibition covers natural reserves, except as provided in the management plan adopted under sections 29, 32, 37 or 50, or by derogation granted pursuant to section 83, subsection 3 of the ordinance. The second paragraph of Article 27 provides that the government may specify the prohibitions referred to in the first paragraph and may, for reasons of nature preservation, take additional general measures in favour of nature

reserves applicable within or outside the scope of the reserve, such as adoption of environmental quality standards.

2. SCOPE OF APPLICATION OF THE RULES ON REMOTELY PILOTED AIRCRAFT IN BELGIUM. AUTONOMOUS FLIGHTS

Article 3, § 1 defines the scope of application of the royal decree. Thus, it applies to any remotely piloted aircraft taking off or landing on Belgian territory or undertaking part of its flight in Belgian airspace, when it is not covered by European regulations. The royal decree explicitly excludes the following cases from its scope of application:

- remotely piloted aircraft operated inside buildings;
- remotely piloted aircraft used during the course of operations by the military, customs and excise, police, search and rescue, firefighting, coastal surveillance or similar operations or activities.

The royal decree provides specifically in Article 3, § 2 that the provisions of Article 4 and the following of the decree do not apply to model aircraft with a maximum take-off mass of less than 1 kg, if their use meets the following conditions:

- they are used solely for recreational purposes;
- they fly at a height above the ground that does not exceed 10 m;
- they are used in the private sphere and away from any public spaces;
- they do not fly within a radius of 3 km of airports or civil and military aerodromes;
- they do not fly over industrial complexes, prisons, the Zeebrugge LNG terminal, nuclear power stations or open-air gatherings;
- the user takes care not to compromise the safety of other aircraft or people or assets on the ground;
- the user respects applicable privacy legislation.

In addition, the royal decree prohibits explicitly autonomous flights of remotely piloted aircraft. The provision of Article 3, § 3 reads, as follows: "The use of autonomous aircraft, i.e. unmanned aircraft that do not permit real-time intervention by a pilot to manage the flight, is forbidden".[98] The text of this provision is problematic in least two directions.

First, the royal decree does not define unmanned aircraft but defines 'manned aircraft' in Article 1 (11). The legislator's juridical technique could be criticised for its poor choice to extract the meaning of a notion that is used to define an exception by means of a logical argument *a contrario* (appeal from the contrary). Instead, a clear definition of 'unmanned aircraft' should have been provided, similarly to the approach chosen in EASA's 'Prototype' Regulation or the European Commission's Proposal for Basic Regulation.

Second, the provision seemingly does not prohibit *per se* autonomous flights but rather autonomous flights that *do not permit real-time intervention by a pilot* (emphasis added). It

[98] In French : « §3. L'utilisation des aéronefs autonomes c'est-à-dire des aéronefs non-habités ne permettant pas l'intervention d'un pilote en temps réel pour gérer le vol est interdite. »

could be argued that a fully autonomous system is not prohibited by the royal decree as long as the possibility for manual control by the pilot is retained and made available at all times. However, it is reasonable to ask if this was indeed the rationale behind this provision. The systemic place of the provision is in the chapter devoted to the scope of application of the royal decree.[99] Does that imply that the legislator's intent was to exclude altogether any form of autonomous flights from the royal decree's scope of application? The result of a teleological interpretation of the provision in line with the outlined international rules and policy guidelines could be a sign of the legislator's intention to exclude only fully autonomous flights. This will be in line with the idea of maintaining control over the aircraft at all times which is an obligation placed on the remote pilot. Thus, it is reasonable to accept a corrective interpretation (*interpretatio correctiva*) that prohibits fully autonomous flights only, to the extent that they deprive the remote pilot of the ability to intervene in the aircraft's operation, change its mission etc.

The royal decree provides for the possibility of derogations from some of its provisions. A reasonable question could be asked as to whether a derogation from the prohibition of (fully) autonomous flights is possible. Article 5 of the royal decree provides that the Minister or their delegate, the Director General, may authorise a derogation to the provisions of Articles 6 to 14 of this decree if the proposed operations present an acceptable level of safety both for air traffic and for people and assets on the ground. Articles 6 to 14 of the royal decree establish the rules of the air and the explicit reference to them only leads one to the conclusion that a derogation from Article 3, § 3 on this legal ground is not be possible. However, Article 4, which is in the chapter delineating the decree's scope of application, stipulates that the minister may authorise derogations to the conditions of this decree for activities of *public interest* such as traffic surveillance activities or environmental control missions undertaken *by or on behalf of* public authorities (emphasis added). First, the decree refers to the notion of 'public interest' which is not explicitly defined.[100] Nevertheless, the provided examples of environmental control missions could, for instance, refer to air quality monitoring missions, such as one of the use cases in SafeDroneWare. This division seems to be a reference to the classical distinction between state and civil aircraft whose roots could be dated back to the days before the adoption of CC44. Second, the main criterion for distinguishing between missions in public or private interest seems to be the circumstance whether the mission is undertaken *by* or *on behalf of* a public authorities. This implies that a mission could be carried out both a public body and by a private entity entrusted with the task of carrying out a mission on behalf of a public authority.

A reasonable question to ask is whether the possibility for derogations referred to in Article 4 could be exercised in respect of any provision of the royal decree. The text seems to be clear in specifying that the derogations could cover *the conditions of this decree*, ie any provision of it, including Article 3, § 3, as long as the conditions for the derogation are met. Furthermore, its systemic place in the chapter defining the scope of application of the royal decree is a strong indication that the legislator's intent was to provide for a possibility for derogation to any conditions of the royal decree. Thus, it could be concluded that fully autonomous flights are

[99] Article 3 of the Royal decree.
[100] Jean Pierre Kesteloot, "L'arrêté Royal Du 10 Avril 2016 Relatif Aux Drones : Premier Commentaire," *Revue générale des assurances et des responsabilités*, no. 6 (2016): 3.

possible, however, only subject to a derogation by the Minister subject to the conditions of Article 4 of the royal decree in the context of activities of public interest undertaken by or on behalf of public authorities.

Finally, the provision of Article 6 of the royal decree explicitly prohibits any operations of remotely piloted aircraft which include (exhaustively listed): (1) operation on ATS (Air Traffic Service) routes such as those referred to in Article 2(46) of Implementing Regulation (EU) No 923/2012; (2) carrying of passengers; (3) carrying of mail or freight; (4) dropping of objects or undertaking spraying while in flight; (5) towing; (6) performing aerobatics; (7) flying in formation. The drafters' choice to exclude carrying mail or freight of the scope of the royal decree is severely criticised in literature.[101] It is argued that if the transportation of passengers is prohibited on the grounds of safety, the prohibition of carrying of mail or freight can hardly be justified for these same reasons. Furthermore, since this is one of the most prominent sectors for commercial applications of remotely piloted aircraft, the prohibition seems to be too restrictive.

3. ACTORS INVOLVED IN REMOTELY PILOTED AIRCRAFT OPERATIONS. RIGHTS AND OBLIGATIONS

The royal decree defines several actors in line with the recommendations of ICAO and the distinctions made at EU level. In this sense, the Belgian legislation does not deviate from the existing international practice.

The royal decree defines the following main actors of relevant for operations of remotely piloted aircraft.

3.1.Manufacturer

The manufacturer is not explicitly defined as an actor by the royal decree. Its role is mainly defined through the obligations that are imposed upon it. The manufacturer has, among other, the following key obligations:

- The manufacturer is obliged to create an **RPAS flight manual** (arg. Article 44, § 1 and § 2).
- The manufacturer of a RPAS or his representative may ask DGTA, for a type of RPAS, to examine: (1) the **compliance of the RPAS** with the technical specifications listed in the RPAS flight manual or an equivalent document; and, (2) **fitness to be operated** under the specified conditions (arg. Article 42, § 1).
- The manufacturer must prepare a **maintenance manual** describing the actions to be taken to maintain the characteristics of RPAS in time (arg. Article 42, § 3, 3 °).
- The manufacturer must **set the conditions** for keeping the RPAS with its command and control system **airworthy** (arg. Article 46).

[101] Ibid., 6.

In addition, if involved in the operation of the RPAS, the manufacturer shall immediately report any incident or accident arising during use of the RPAS to the DGTA and the Air Accident Investigation Unit pursuant to Article 96 of the royal decree.

It could be said that the manufacturer's obligations are mainly related to ensuring the compliance, airworthiness and fitness for operation of the remotely piloted aircraft. Ensuring the safety of the flight itself comprises a set of obligations divided between the operator and the remote pilot.

3.2.Operator

The operator is defined by Article 1(6) of the royal decree as "a natural or legal person operating or proposing to operate one or more remotely piloted aircraft". The definition is clear in specifying that the act of operating a remotely piloted aircraft is not *conditio sine qua non* for determining a party as an operator; a mere proposing to operate one or more remotely piloted aircraft is sufficient.

The operator has a number of obligations which could be summarised in the following way:

- Guarantee safety of operations (arg. Article 80, § 1 (1))
- Undertake maintenance operations (arg. Article 80, § 1 (2))
- Keep a maintenance log for each RPAS (arg. Article 80, § 1 (3))
- Ensure adequate insurance policy (arg. Article 80, § 1 (4))
  Operators using remotely piloted aircraft shall be insured according to Article 7 of Regulation (EC) No 785/2004 of the European Parliament and of the Council of 21 April 2003 on insurance requirements for air carriers and aircraft operators (arg. Article 97)
- Ensure the processing of any personal data takes place in accordance with the legislation (arg. Article 80, § 1 (5))
- Provision of information and documents to the General Director (arg. Article 80, § 1 (6))
- Submission to monitoring by DGTA (arg. Article 80, § 1 (7))
- Maintain RPAS/command and control system airworthy (arg. Article 46)
  This obligation is not strictly addressed to the operator and it could also be imposed on the remote pilot. In any case, the responsible party should make sure that both the RPAS and the command and control system are kept in compliance with the initial type definition and the conditions set out by the manufacturer.
- Preserve declarations of incidents or events compromising safety (arg. Article 87)
- Carry out prior risk analysis for the envisaged class 1 operations (arg. Article 66 (4) *juncto* Article 68).

In addition, the operator shall immediately report any incident or accident arising during use of the RPAS to the DGTA and the Air Accident Investigation Unit pursuant to Article 96.

It should be kept in mind that the operator's role could in certain cases overlap with the role and obligations of the remote pilot. Thus, it is important to examine each particular situation on a case-by-case basis in order to determine and allocate the responsibilities.

3.3.Remote pilot

Article 1 (7) defines a remote pilot as "a person who performs the tasks essential to the operation of a remotely piloted aircraft and who, where applicable, operates the flight controls of a remotely piloted aircraft during its flight".

The remote pilot's obligations could be summarised in the following way:

- Monitor the operation and status of the aircraft at any time (arg. Article 83(1))
- Control the operation of the RPAS during the flight time (arg. Article 82)
- Keep control of the aircraft at all times (arg. Article 83 (2))
  This obligation seems to repeat the obligation imposed by Article 82 to control the operation of the RPAS during the flight time. It was already mentioned above, in the discussion on autonomous flight, that this requirements prohibits fully autonomous flight, that is to say, flights that do not *allow for* the intervention of a human pilot. The temporal notion 'all times' is not defined by the royal decree but it is reasonable to assume that this includes at least the possibility for intervention on the part of the remote pilot at any time from the take-off to the landing.
- Respect a safety distance between their RPA and any other type of aircraft approaching the operation zone of the RPA, and from any other object or obstacle on the flight path of the RPA (arg. Article 9 (2))
- Maintain sufficient distance from all other aircraft (arg. Article 9(1))
- Maintain a reasonable and appropriate distance between the RPA and any surrounding obstacles[102] (arg. Article 11(1))
- Keep a minimum distance of 30 metres from an obstacle (arg. Article 11(2))
- Keep a distance between the remote pilot and the RPA which may not under any circumstances exceed the range of the radio connection with the RPAS (arg. Article 12, para 2)
- Give way to all manned aircraft (arg. Article 10 (1))
- Maintain direct unaided visual contact with the RPA (arg. Article 12(1))
- Fly within direct view of the remote pilot or RPA observer (arg. Article 14 (2))
  This obligation could be derogated by advance authorisation of the Minister pursuant to Article 14 (3).
- Fly away from clouds (arg. Article 14 (1))
  This obligation could be derogated by advance authorisation of the Minister pursuant to Article 14 (3).
- Ensure that minimum meteorological conditions are met along the route (arg. Article 83(3), Article 14, para 3)

[102] The provisions of the Commission Implementing Regulation 932/2012 define 'obstacle' as : «all fixed (whether temporary or permanent) and mobile objects, or parts thereof, that: (a) are located on an area intended for the surface movement of aircraft; or (b) extend above a defined surface intended to protect aircraft in flight; or (c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation» (In French : « tous les objets fixes (provisoires ou permanents) et mobiles, ou des parties de ces objets, qui : a) sont situés sur une zone destinée aux évolutions des aéronefs à la surface ; ou b) s'étendent au-dessus d'une surface définie, destinée à protéger l'aéronef en vol ; ou c) se trouvent en dehors de ces surfaces définies et ont été jugés comme représentant un risque pour la navigation aérienne ») (arg. Articles 2, 98)

- Ensure take-off mass does not exceed 150 kg (arg. Article 1 (4))
  If the take-off mass exceeds 150 kg, the operation will fall within the ambit of the Basic Regulation and will be subject to the much stricter requirements for airworthiness and certification of the manned aviation.
- Ensure take-off and landing zone conditions (arg. Article 84, § 3)
  This obligation is a complex one because it contains the following elements that should be taken into account: (1) free of any obstacles (Article 84, § 3 (4)); (2) have necessary equipment (Article 84, § 3 (3)); (3) offer adequate surface conditions for the type of operation (Article 84, § 3 (5)); (4) ensure sufficient safety conditions (Article 84, § 3 (1)); (5) be well dimensioned (Article 84, § 3 (2)).
- Maintain horizontal visibility at least equal to 1.5 times the distance between the RPA and the remote pilot or RPA observer (arg. Article 14 (3))
- Keep control of the aircraft at all times (arg. Article 83 (2))
- Maintain RPAS/command and control system airworthy (arg. Article 46)
  As noted above, the royal decree does not impose this obligation on a specific party. Even though it is reasonable to assume that the operator is the party that should be responsible for the airworthiness of the remotely piloted aircraft and the command and control system, it is not impossible that this obligations might also be imposed on the remote pilot in certain circumstances.
- Ensure that the RPAS has been well maintained before each flight (arg. Article 83 (5))
- Possess sufficient knowledge of the layout of the aerodrome or the operating site (arg. Article 84, § 2)
- Prepare the flight at an aerodrome or an operating site (arg. Article 84, § 1)
- Terminate flight in situations involving danger for air traffic (arg. Article 7)
  This obligation is subject to two cumulative conditions that should be present at the same time: (1) all safety requirements must be met before the termination of the flight; (2) the flight must be terminated as soon as the requirements are met. The notion of 'danger for air traffic' is not defined by the royal decree but it is reasonable to assume that it should be interpreted broadly to include any event that might endanger manned or other unmanned aircraft.
- Keep a flight log for all flights (arg. Article 16 (1) and (2))
- Ensure the RPA maintains continuous command and control link (arg. Article 8 *juncto* Article 1 (6) *juncto* Article 93, para 1)
- Develop procedures for loss of connection (arg. Article 8 (1) *juncto* Article 45 (2) *juncto* Article 93 (2))
- Implement the established procedures in the event of loss of the command and control connection/link (arg. Article 8 (1))
- Ensure compatibility of remote pilot station with the RPA (arg. Article 8, para 2)
- Ensure availability of resources necessary for a safe flight (arg. Article 83 (6))
- Consider the requirements mentioned in the flight manual of the RPAS (arg. Article 84, para 2)

It is not clear how compliance with this obligation must be ensured but it is reasonable to assume that if the flight manual prescribes some specific requirements, these should in all cases be taken into account by the remote pilot.

- Consider other activities on the ground, topography, obstacles, atmospheric effects on radio communications and interference with the frequencies used (arg. Article 83 (7))
  Similar to the previous obligation, this obligations implies that the remote pilot should take into account all the relevant factors on the ground before and during the implementation of the operation. These obligations are particularly suitable for execution in an automated manner since this would enable the remote pilot to take quick decisions.
- Compliance with weight and centre of gravity restrictions (arg. Article 83 (4))
- Compliance with the privacy legislation in force (arg. Article 83 (9))
  This obligation is not further specified by the royal decree. However, the applicable provisions of the privacy legislation, including but not limited to the Belgian Data Protection Act, the General Data Protection Regulation and other legal instruments should apply in full effect.

Article 96 provides that the remote pilot shall immediately report any incident or accident arising during use of the RPAS to the DGTA and the Air Accident Investigation Unit.

3.4.Observer

Article 1 (8) of the royal decree defines the 'RPA observer' as 'a trained and competent person, designated by the operator, who, by visual observation of the remotely piloted aircraft, helps the remote pilot to undertake the flight in complete safety, according to the requirements of this decree'.[103] The law limits the number of observers to two people (arg. Article 12(2)).

The RPA observer's presence is only required in certain circumstances. Thus, Article 65 (4) prescribes that class 2 operations shall be carried out on the following conditions: (…) the flight is operated in accordance with the rules of the air, in particular the height specified in Article 13, § 1, and *without the aid of an RPA observer* (emphasis added). Thus, it follows that class 2 operation should be carried out without the aid of an RPA observer, leaving the role of an RPA observer applicable only to class 1 operations.

The RPA observer's obligations could be summarised in the following way:

- Fly within direct view of the remote pilot or RPA observer (arg. Article 14(2))
- Maintain horizontal visibility at least equal to 1.5 times the distance between the RPA and the remote pilot or RPA observer (arg. Article 14(3))
- Maintain direct unaided visual contact with the RPA (arg. Article 12(1))

In addition, the RPA observer shall immediately report any incident or accident arising during use of the RPAS to the DGTA and the Air Accident Investigation Unit pursuant to Article 96.

[103] In French : « une personne formée et compétente, désignée par l'exploitant, qui, par observation visuelle de l'aéronef télépiloté, aide le télépilote à réaliser le vol en toute sécurité en respectant les exigences du présent arrêté »

3.5.Minister

The law entrusts the minister with several tasks in the regulation of remotely piloted aircraft operations. As already pointed out, Article 4 of the royal decree stipulates that the minister may authorise derogations to the conditions of this decree for activities of public interest such as traffic surveillance activities or environmental control missions undertaken by or on behalf of public authorities.

It is noteworthy that Article 68(3) of the royal decree establishes a legal fiction in stipulating that operations carried in derogation from the provisions made by the royal decree are considered class 1a operations, ie operations with increased risk.

The Minister or their delegate, the Director General, may also give advance authorisation for operations derogating the conditions set out in Article 14(1), including night operations if these are undertaken in a Temporary Reserved Airspace (TRA) or Temporary Segregated Airspace (TSA), setting the conditions for these operations, and taking into account the technical and operational characteristics of the RPAS (arg. Article 14(3)). This provision also stipulates that a derogation from the rules on flying within direct view of the remote pilot or RPA observer is possible by advance authorisation pursuant to Article 14(3).

4. EXPLOITATION AND SAFETY RULES. EXCEPTIONS

In addition to the rules establishing the rights and obligations of the different actors, the royal decree also provides for the exploitation and safety rules concerning remotely piloted aircraft operations. These rules could be divided in three main categories, ie, common rules, applicable to all types of operations, and special rules, applicable, respectively, to class 1 or class 2 operations.

In literature, the following two main types of risk have been identified when it comes to the operation of remotely piloted aircraft: (1) interference and conflict with other airspace users, including mid-air collision, remotely piloted aircraft ingestion in aircraft turbine engine, etc. and (2) damage to the public and property on the ground as a result of a crash.[104]

4.1.Common rules

The common rules match exactly the obligations of the different actors outlined in the previous section. Unless explicitly referring to a particular class of operations, these rules are equally applicable to both class 1 and class 2 operations. Thus, these rules will not be analysed further in this sections.

4.2.Class 2 operations

The provision of Article 1 (17) defines class 2 operation as "all aviation activity in which an RPA with a maximum take-off mass of less than 5 kg is used for activities such as aerial photography, surveying and observing and represents low risk for aviation safety, people and

[104] Bernauw, 239.

property on the ground". Article 65 further specifies that Class 2 operations shall be carried out on the following conditions:

- the remote pilot holds a remote pilot certificate or a remote pilot licence;
- the RPAS is registered under Article 57 or has an equivalent document issued by an aviation authority of a Member State of the European Union;
- the operation is not an operation of Class 1;
- the flight is operated in accordance with the rules of the air, in particular the height specified in Article 13, § 1, and without the aid of an RPA observer;
- the flight is operated in an area which, within a radius of minimum 50 m, is free of any building, any person not involved in the operation, or an animal gathering.

Thus, at least six main criteria should be met cumulatively for an operation to be considered a class 2 operation, ie one representing low risk for aviation safety, people and property on the ground. These could be classified, as follows:

- Physical requirements, referring to the characteristics of the aircraft or the , ie, take-off mass not exceeding 5 kg (arg. Article 1(17))
- Operational requirements, referring to the limitations that should be observed while the aircraft is engaged in an operation, ie:
    - **Height above ground level should not exceed 150 feet (45.72 m)** (arg. Article 13(1))

      In particular, Article 13 (1) provides that class 2 operations shall be limited to flights within visual line-of-sight (VLOS) to a height of 150 feet AGL in uncontrolled airspace. The following operations are prohibited in all circumstances: (1) in controlled airspace or airspace with a special status (forbidden areas (P), danger areas (D), restricted areas (R) helicopter training areas (HTA), low flying areas (LFA)) when they are active; (2) in temporarily reserved airspace (TRA) or temporarily segregated airspace (TSA); and (3) within a radius of 1.5 nautical miles of aerodromes for aircraft or ultra-light motorized aircraft and within a radius of 0.5 nautical miles of heliports, without prior authorization of the operator of the aerodrome or heliport.
    - **Area in which the aircraft is operated should be free of any building, person not involved in operation, animal gathering within a radius of minimum 50 m** (arg. Article 65(5))
    - **Observation of the rules of the air** pursuant to Article 13(1), in particular the height specified in Article 13, § 1 (arg. Article 65(4))
    - Operation should be carried out **without the aid of an RPA observer** (arg. Article 65(4))
- Risk assessment requirements, referring to the gravity of the involved risk, ie the operation should present a low risk (cumulatively) to:
    - Aviation safety
    - People
    - Property on the ground

- Purpose requirements, referring to a specific set of exhaustively listed purposes which the operation has to be compliant with (alternatively):
    - Aerial photography
    - Observation
    - Surveying

With respect to the purpose requirements, it is worth noticing that the royal decree does not define the notions of 'observation' or 'surveying' which leaves somewhat wide margin of discretion to the involved parties to determine the specific purpose of the operation. However, it should be kept in mind that for an operation to be considered a class 2 operation, all types of requirements listed above should be met cumulatively.

4.3.Class 1 operations

Article 1(18) of the royal decree provides that class 1 operations include "all aviation activity in which an RPA is used and is likely to represent a moderate or increased risk to aviation safety and/or persons and property on the ground because it is carried over an area where the security of third parties on the ground may be compromised in case of an emergency or poses a significant risk because of its special nature and the local environment in which it takes place." Whether the risk is increased or not is the subject of the risk analysis under Article 68.

Class 1 operations are further divided in subclasses, ie: class 1a and class 1b depending on whether the risk is increased or moderate. Before embarking on analysis of the specific rules, it should be noted that the royal decree establishes several common rules that apply to both types of class 1 operations. These rules include:

- Submission of an advance notification to DGTA (arg. Article 66(2))
- Creating an operating manual compliant with RPAS flight manual and safety recommendation of DGTA (arg. Article 66 (5) *juncto* Article 78, para 1 and 2 *juncto* Article 79 *juncto* Article 80, § 2 *juncto* Annex 4 'Content of the operating manual')
- Flight in accordance with the procedures of the operating manual (arg. Article 80, § 2 (5))
- Height above ground should not exceed 300 feet/91.44 m. (arg. Article 13, § 2)
- Prior risk analysis by the operator for the envisaged operations (arg. Article 66 (4) juncto Article 68), which should take into account at least the following criteria:
    - Aviation safety
    - Safety of people
    - Safety of property
    - Environment
    - Nature of the envisaged operations
    - Place

The prohibitions of Article 13(2) of the royal decree are also applicable to class 1 operations. Thus, the following operations are prohibited:

- In controlled airspace or airspace with a special status
- In temporarily reserved airspace (TRA) or temporarily segregated airspace (TSA)

- Within a radius 1.5 nautical miles of aerodromes for aircraft or ultra-light motorized aircraft and within a radius 0.5 nautical miles of heliports, without prior authorization of the operator of the aerodrome or heliport.

It is worth noting that the royal decree provides for an exception to the prohibition of carrying out operations within a radius of 30 m of an obstacle, provided that the risk analysis demonstrates that class 1 operations.

4.3.1. Class 1a operations

Article 1(19) of the royal decree defines 'class 1a operation' as any exploitation of class 1 which represents an increased risk. Furthermore, Article 68(3) establishes a legal fiction that three particular types of operations are *ipso facto* considered class 1a operations. Such are operations:

- carried over or near a gathering of people; or,
- involving the overflight of people; or,
- carried out in derogation from the provisions made by the royal decree.

The specific requirements for class 1a operations include:

- Need of approval/equivalent document issued by a competent authority (arg. Article 66, § 1 (2))
  The RPAS used for class 1a operations must have a certificate of compliance issued in accordance with Article 48 or an equivalent document issued by a competent authority of a Member State of the European Union.
- Certificate of compliance (arg. Article 66, § 1 (3))

4.3.2. Class 1b operations

Article 1(20) of the royal decree defines class 1b operations as "any exploitation of class 1 which represents a moderate risk". In addition to the common rules for class 1 operations, Article 66 (6) provides that the operator must have received the acknowledgment of the declaration referred to in Article 72.

5. LIABILITY AND INSURANCE ISSUES

The analysis so far has demonstrated that the law mandates a very strict set of safety and exploitation rules to be observed by the various actors involved in operations of remotely piloted aircraft. In terms of liability, however, the law is not very specific about the applicable rules of the allocation of liability.

In principle, Article 82 of the royal decree provides that the remote pilot shall be responsible for the operation of the remotely piloted aircraft system during the flight. Some authors believe that this provision does not establish a strict liability regime for the pilot's actions during the

flight.[105] Instead, they see in this provision an indication of the pilot's responsibility to conduct the flight and refer to the Chicago Convention's notion of 'pilot in command' referred to in Articles 4.5.1 and the following of Annex 6 to CC44.[106] The liability for damages of the remote pilot, the operator or the manufacturer should be treated in the classical manner as tort liability.

It is beyond doubt that the remote pilot, in the sense used by the royal decree, acts as the pilot in command, ie the pilot responsible for the operation and safety of the aircraft during flight time (arg. Chicago Convention Annex 2, Art. 2.3.1. and Art. 2.4). As such, the remote pilot may incur "possible types of liability".[107] In fact, in literature, it is argued that there is "no fundamental difference between the fly-by-wire on-board pilot (often supervising the auto-pilot) and the remote pilot".[108]

Circular Cir 328-AN/190, C-WP/9781[109] makes the pilot in command of the remotely piloted aircraft responsible as a pilot of a manned aircraft for the detection and avoidance of potential collisions and hazards. It is argued that remote pilots, while not on board the aircraft, will still be subject to the same requirements as aircraft pilots in that they are required to observe, interpret and consider a wide range of visual signals designed to attract their attention or convey information.[110] The detect and avoid technology should allow for the detection of an obstacle long before the human eye and should enable the implementation of procedures for avoidance or, where applicable, the automatic avoidance of the obstacle.[111] Technology, particularly software, could be especially useful in conveying this information in a meaningful and useful manner to the pilot by employing the existing techniques known from manned aviation.

If the remote pilot is indeed to be treated as a 'pilot in command' in a manned aircraft context, a reasonable question to ask is, what is then the nature of the operator's liability?[112] The royal decree is silent on the operator's liability, save for the provision of Article 97 on insurance. Article 97(1) provides that any operator using an RPAS for commercial activities shall be insured according to Article 7 of Regulation (EC) No 785/2004 of the European Parliament and of the Council of 21 April 2004 on insurance requirements for air carriers and aircraft operators. The second paragraph of Article 97 establishes the regime for non-commercial activities by stipulating that any operator, or by default any remote pilot of an RPAS used exclusively for non-commercial activities, shall take out civil liability insurance to cover third-party bodily injury and material damage.

While remotely piloted aircraft fall within the scope of Regulation (EC) No 785/2004, its provisions are limited. For example, pursuant to Article 2 of the regulation, it does not apply to: state aircraft as referred to in Article 3(b) CC44; model aircraft with a maximum take-off mass (MTOM) of less than 20 kg; aircraft, including gliders, with an MTOM of less than 500

[105] A. Cassart, "Drones : Y a-T'il Un Télépilote Dans L'aéronef?," *Revue du Droit des Technologies de l'Information (R.D.T.I.)* 2016, no. 1 (2016): 86.
[106] Ibid.
[107] Bernauw, 244.
[108] Ibid., 247.
[109] ICAO.
[110] Abeyratne, *Convention on International Civil Aviation : A Commentary*, 129.
[111] Lars Hoppe, "Le Statut Juridique Des Drones: Aéronefs Non Habités" (Aix-Marseille 3, 2006), 263.
[112] M. Wouters, "Drones : De Juridische Toekomst Voor Onbemande Vliegtuigsystemen," *Cahier du juriste - van de jurist* 2016, no. 1 (2016).

kg, and micro lights, which are used for non-commercial purposes or are used for local flight instruction which does not entail the crossing of international borders.

Some authors have argued that if damages are incurred by third parties on the ground, the strict liability provided for by Article 1 of the Rome Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface of 1952 will apply. They argue that this strict liability rests on the operator, according to the class of operation and is subject to the aforesaid insurance obligation.[113] The difficulties in applying the Rome Convention to the case of remotely piloted aircraft were already discussed above in Chapter I, 3. The criticisms are equally valid in a national context. While the royal decree solves the problem of identification by introducing a mandatory registration of the aircraft pursuant to Article 53 and the following, other criticism could still be made that would hinder the application of this regime. Furthermore, the registration of the remotely piloted aircraft in the register does not constitute a title of ownership of the aircraft, but merely creates a presumption of ownership.[114]

Finally, the prohibition of carrying passengers or mail and freight mean that the neither the regime of the Montreal Convention, nor the one of the Warsaw Convention shall be applicable to remotely piloted aircraft in the sense of the royal decree.[115]

It follows from this brief overview of the liability and insurance regime that the remote pilot will most likely be treated in the same manner as the pilot in command of a manned aircraft. However, the specific allocation of liability between the different actors involved in the chain of a remotely piloted aircraft operation will depend on the relationships and involvement in the operation of the various actors. In any case, in the absence of specific rules on liability, the general rules of civil law for contractual and extra-contractual liability will be applicable. Due to the specifics of each case, the assessment will have to be made on a case-by-case basis, hence no general conclusion could be made.

6. PRIVACY AND DATA PROTECTION RISKS

While the present report is focusing exclusively on the safety rules applicable to remotely piloted aircraft, it should be noted that privacy and data protection risks could also play a significant role in terms of liability for the involved parties.

Thus, for example, at least the following two groups of risks should be considered:

- Intrusion in case of unauthorised overflying of private property[116] or overflying prohibited or protected zones
  It is well-known that modern aviation has reduced the relevance of the 'unlimited vertical property right' over land. However, it is not unreasonable to assume that an aircraft overflying private land at a very low altitude could be considered "a direct and

[113] Cassart, 86.
[114] Kesteloot, 11. See also Max Litvine and Armand Moury, *Droit Aérien: Notions De Droit Belge Et De Droit International* (É. Bruylant, 1970), 147.
[115] Kesteloot, 6.
[116] Bernauw, 242.

immediate interference with the enjoyment and use of the land" and would as such be prohibited.[117]

- Violation of fundamental rights of citizens to privacy and data protection stemming from Article 8 of the European Convention on Human Rights and the national legislation on privacy and data protection. These risks concern operation by both public actors, such as state authorities, and private entities, such as companies.
  The most widely acknowledged risk to rights to privacy and data protection is related to the clandestine taking of photographs and videos of individuals. Article 36 CC44 provides that each contracting State may prohibit or regulate the use of photographic apparatus in aircraft over its territory. In Belgium, the rules introduced by the Royal Decree of 21 February 1939 subjecting aerial photography from manned aircraft to an authorisation of the civil aviation administration have been repealed.[118] Thus, presently, the taking of aerial photography is not subject to a special authorisation. Nevertheless, as prescribed by the royal decree, the remote pilot should observe privacy and data protection legislation which necessitates that whenever personal data are processed, be it intentionally or inadvertently, the rules shall be observed strictly.
  Since the legal issues of privacy and data protection are outside the scope of the present report, they will not be analysed in further details.[119]

7. CONCLUSIONS

The analysis of the Belgian legal framework applicable to remotely piloted aircraft demonstrates both advantages and disadvantages in terms of effect on the nascent market of commercial applications of remotely piloted aircraft.

In terms of advantages, the royal decree of 2016 brought the long-awaited legal certainty by explicating regulating remotely piloted aircraft operations. Furthermore, its strict rules on exploitation and safety aim to guarantee that there will be minimum risk to both the safety of manned aviation and the safety of people and property on the ground.

In terms of disadvantages, the royal decree seems to have 'missed the right time' by coming already too late on the stage.[120] Furthermore, the prohibition of autonomous flights and the restrictions on the transport of goods and spraying significantly hinders innovation. While the derogation procedure is certainly an option that many commercial operators may decide to pursue, it risks turning the exception into the rule which, in turn, will reduce the royal decree's scope of application mainly to operations for recreational purposes.

[117] Ibid.
[118] Ibid., 242.
[119] For more details on the data protection issues in the context of remotely piloted aircraft, refer to, *inter alia*, Grigorios Tsolias, "Greece· Data Protection Risks from the Use of Remotely Piloted Aircraft Systems (Rpas) under the Vague Legal and Regulatory Framework," *European Data Protection Law Review* 2, no. 3 (2016).
[120] Riger-Brown.

CHAPTER IV

GUIDELINES FOR DEVELOPERS OF SOFTWARE FOR REMOTELY PILOTED AIRCRAFT SYSTEMS

The inventory of the applicable laws and regulation to the operation of remotely piloted aircraft systems reveal a picture of diverging, often conflicting rules whose scope of application is not always clearly defined. The national legislation of Belgium introduced the long-awaited legal certainty but at the same time, it hindered the innovative potential of the nascent market of commercial applications of remotely piloted aircraft. Against this backdrop, the final chapter of this report attempts to provide a set of simple guidelines for software developers to follow and implement the applicable legal rules when developing software for remotely piloted aircraft.

1. REQUIREMENTS ENGINEERING AND THE LAW

The law has significant impact on the design and development of software and frameworks such as SafeDroneWare make no exception. Regulations have significant impact on the elicitation of the requirements of a software system. Furthermore, the impact of standards such as DO-178B and DO-178C and their equivalents in Europe published by EUROCAE as ED-12B ED-12C.

In the field of aviation, the process is even more complicated because it involves the process of certification. Thus, avionics software is often referred to as embedded software with legally mandated safety and reliability features. Certification in aviation is defined "legal recognition by a certification authority that a product, service, organization or person complies with some specific requirements".[121] It follows that correctness, predictability and full compliance at the requirements engineering stage are crucial for safety-critical software.

The elicitation of legal requirements is a challenging task. Legal rules are often well-structured and hierarchical but at the same time secondary legislation and case law could bring about uncertainty, diverging enforcement and interpretation of this system of rules.[122] Furthermore, legal provisions often rely on multiple cross-references to other legal provisions which could be amended, repealed or construed differently with the passing of time. The main issue, however, remains the law's ambiguity which is inherent to its purpose of accommodating as much possible scenarios within its scope as possible to ensure its universal application on the territory of a state.

The ultimate goal of companies and software developers is to make sure their software is compliant with relevant laws and regulations to avoid the risks of penalties and reputation loss

[121] Gabriella Gigante and Domenico Pascarella, "Formal Methods in Avionic Software Certification: The Do-178c Perspective" (paper presented at the International Symposium On Leveraging Applications of Formal Methods, Verification and Validation, 2012), 4.
[122] Paul N Otto and Annie I Antón, "Addressing Legal Requirements in Requirements Engineering" (paper presented at the Requirements Engineering Conference, 2007. RE'07. 15th IEEE International, 2007), 6.

as a result of non-compliance.[123] As non-functional requirements, the legal requirements are often placed in the category of constraints before the design of a particular functionality. Thus, for example, the requirement that the *remotely piloted aircraft shall maintain sufficient distance from other aircraft to minimise effects of wake turbulence* acts as a constraint before the range of movements of the aircraft. This requirement is not quantifiable, as 'sufficient distance' is not defined by the rule in nautical miles or another unit. What are the possible solutions before the developer in this case? They could refer to ICAO's standards on separation minima defined in nautical miles. However, these standards were adopted to respond to the effects of wake turbulence on manned aircraft which are significantly heavier. If applied to remotely piloted aircraft, these standards might prove inadequate, insufficient or completely inapplicable not least because of the fact that small remotely piloted aircraft are more sensitive to wake turbulence than manned aircraft. Furthermore, the developer could refer to industry standards, if any, that could act as a guideline. In any case, however, the uncertainty of whether the software is compliant with the rule will be an ongoing issue.

In literature, various approaches for the classification and tracing of non-functional software requirements have been suggested.[124] The common problem of these approaches is that either they often adopt a very simplistic view of the legal system or the suggested solutions are too complicated for a legal expert to be involved in the process.[125] In order to design legally compliant systems, the legal texts should be carefully analysed by teams comprising both engineers and legal experts. Some authors[126] have suggested that in the process at least the following main issues should be considered:

- ***Information extraction from law***, ie finding the requirements, identification of relevant pieces of information and understanding the relationships between the elements.
- ***Choice of law***, ie analysis of all relevant regulations and prioritisation in line with their legal effect and force.
- ***Imperfection and vagueness of the law***, ie interpretation of the rules in order to establish their true meaning.
- ***Dynamics of the law***, ie taking into account the continuous evolution of the legal system and providing for mechanisms to adjust the system to changes occurring on the legal landscape.

In any requirements elicitation exercise, the ultimate goal for the team should be to ensure the traceability from software artefacts to the governing legal text. In the process, careful

[123] Jeremy C Maxwell et al., "A Legal Cross-References Taxonomy for Reasoning About Compliance Requirements," *Requirements Engineering* 17, no. 2 (2012): 99.
[124] Anas Mahmoud and Grant Williams, "Detecting, Classifying, and Tracing Non-Functional Software Requirements," ibid.21, no. 3 (2016). For a criticism of these approaches, see Guido Boella et al., "A Critical Analysis of Legal Requirements Engineering from the Perspective of Legal Practice" (paper presented at the Requirements Engineering and Law (RELAW), 2014 IEEE 7th International Workshop on, 2014), 17 and the following.
[125] David G Gordon and Travis D Breaux, "The Role of Legal Expertise in Interpretation of Legal Requirements and Definitions" (paper presented at the Requirements Engineering Conference (RE), 2014 IEEE 22nd International, 2014).
[126] Nadzeya Kiyavitskaya, Alžbeta Krausová, and Nicola Zannone, "Why Eliciting and Managing Legal Requirements Is Hard" (paper presented at the Requirements Engineering and Law, 2008. RELAW'08., 2008).

assessment should be made to ensure that the removal of ambiguities from the legal text does not result in a wrong specification which is contrary to the legal rule's purpose. The following section aims to present a few important guidelines that should be observed by legal experts and engineers alike and proposes a possible strategy for enhancing the communication process between software engineers and legal experts.

2. PRACTICAL GUIDELINES ON ENGINEERING OF LEGAL REQUIREMENTS[127]

While it is not possible to formulate a set of universally applicable guidelines on how the process of requirements engineering and communication between legal experts and engineers could be improved, the following points aim to act as an initial set of goals that a team should be aiming at.

1.1. Terminology mapping

This step involves the establishing of a common terminology apparatus. It requires that software engineers and legal experts develop a common set of terms which bear the same meaning to both groups. The process involves a thorough study of the available software documentation and the available legal texts, judicial interpretation and other relevant tools.

> ① **GOOD PRACTICE**
>
> *SafeDroneWare* adopted the common terminology used by ICAO and complemented it, where applicable, with the legal definitions used in Belgian legislation.

The initial mapping of terminology will allow the teams to make relevant links and associations. The mapping exercise should further aim at establishing the hierarchical relationships between: (1) *actors*, ie the relevant parties that play a role in the system; (2) *data objects*, ie the types of data, the data flows and the dependencies; and (3) *actions*, ie, the functionality of the system that should be mapped to the legal requirements.

1.2. Requirements identification and disambiguation

This step takes input from the mapping exercise in the first step and defines the requirements for the software system. This step should aim at answering at least the questions of: (1) what a requirement means? (2) Why does it exist? (3) How often does it occur? (4) What happens if it is not present? (5) Who is involved in the action or description? (6) Are there any questions about a user role or a use case?

This step's main purpose is to identify the relationships between the different requirements. These may be relationships of *constraining*, but they may equally be *dependencies*, requirements that *operationalise* other requirements, or requirements that *support* other requirements.

[127] The following guidelines have been largely based on ideas adopted from the works of Paul N Otto and Annie I Antón, "Managing Legal Texts in Requirements Engineering," in *Design Requirements Engineering: A Ten-Year Perspective* (Springer, 2009). and Kiyavitskaya, Krausová, and Zannone.

It should be kept in mind that there will *almost certainly* be legal requirements that cannot be technically satisfied or can be satisfied only partially. In these cases, the legal experts may provide additional guidelines as to what should be observed by the end user of the system or what mitigation measures might have to be taken that cannot be technically implemented in the software.

1.3.Requirements elaboration

This step involves the documenting of the priority and origin of each requirement. At the end of this step, the legal requirements should be formulated in a manner sufficiently clear for software engineers to understand it without the need of specialised legal knowledge. Legal experts should pay specific attention to the risk of creating obstacles or vulnerabilities for legal compliance as well as to the risk of creating wrong representations of the legal rules in their attempt to simplify them and remove the ambiguity.

1.4.Traceability

At this step, the team should make sure that there are sufficiently clear traceability links to legal sources for each requirement from the set of requirements produced by the requirements disambiguation and elaboration exercises.

> ② **GOOD PRACTICE**
>
> *SafeDroneWare* created a requirements matrix that provides sufficiently well elaborated requirements that could be traced back to their source.

3. CONCLUSIONS

The elaboration of guidelines for developers of software on how to implement legal requirements is extremely difficult task. The goal of the points made in the previous section is to present an initial, high-level map of actions that could potentially enhance the process of requirements engineering and help overcome the difficulties encountered in the implementation of ambiguous legal provisions. Compliance is a mandatory requirements for a safety-critical software system, such as the framework that is being developed in SafeDroneWare.

In addition, it should be kept in mind that safety-critical systems often must be compliant not only with the legal rules stemming from the law but also with standards developed and/or adopted by the certification authorities, such as EUROCAE and EASA. Thus, the process of requirements engineering requires strong mutual collaboration between experts in software engineering, standardisation and legal experts to overcome ambiguity and uncertainty and to ensure that the end product is compliant with all safety and other legal requirements.

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